THE IRON TRADE REVIEW

Volume LV Cleveland, July 9, 1914 *No. 2*

More Southern Competition

Insured by Lower Freight Rates—Prospect for Railroad Buying More Encouraging

The decision of the Interstate Commerce Commission in regard to rates on pig iron from the Birmingham district to numerous northern points may have more far reaching effects than appear probable. But at present it seems that the principal result will be considerably more competition in New England for the Buffalo and Virginia furnaces, and for some furnaces in the Chicago district which make high phosphorus pig iron similar to that produced in the south. While the Commission does not advocate making freight rates conform to the selling prices of pig iron, it believes that, as the carriers established such a basis and followed it in past years, it is fair to assume that the rates made during periods of great prosperity are too high to be continued indefinitely. The Commission shows appreciation of the difficulty of even fairly approximating the cost of transporting a unit of freight and realizes that any method of adjusting rates must be somewhat arbitrary.

Pig Iron

The sharp decline in the production of pig iron in June, as compared with May, the figures being 1,904,566 tons and 2,097,019 tons, respectively, shows how quickly blast furnace operators are conforming to the decreased demand for their product, but sellers who have made a careful study of the situation point out that two years ago conditions in the pig iron market were, in some respects, more unfavorable than they are at present. At that time, stocks on hand in furnace yards amounted to 1,400,000 tons, compared with about 1,000,000 tons today and production was at a considerably higher rate. The last half of the year 1912 was one of great prosperity and some furnace men report that they see indications of a good buying movement in pig iron, which they believe will be well under way by Sept. 1 and possibly equal the movement of the last half of 1912. During the past week, there has been increased activity in the Pittsburgh market and two large lots, one of 20,000 tons and another of 10,000 tons, have been sold. Tonnages of good size are pending in the east, but sales are not numerous. The General Electric Co. has purchased 10,000 tons of foundry iron and inquiries are pending for about 50,000 tons of iron for export.

Railroad Buying

Among manufacturers of cars and other kinds of railroad equipment, there is a distinctly more optimistic sentiment and it is believed that liberal buying by the railroads will soon be inaugurated Positive information is to the effect that inquiries for about 10,000 cars will soon appear in the eastern district. The Pennsylvania railroad has distributed the remaining 100,000 tons of its 1914 rail order, 44,000 tons going to the Steel Corporation, 22,000 tons each to the Pennsylvania and Cambria steel companies and 6,000 tons each to the Bethlehem and Lackawanna steel companies. The Seaboard Air Line has ordered 6,000 kegs of spikes and much more spike business is still pending.

Steel and Bars

Two leading eastern agricultural implement makers have contracted for from 15,000 to 20,000 tons of steel bars, but many of these manufacturers in the central west have not yet covered. Mills are firmly resisting efforts of buyers to contract at less than 1.15c, Pittsburgh, which is the prevailing price up to Jan. 1, while 1.20c is the usual quotation for delivery after that date.

THE OPEN HEARTH

Constructive Criticism

A FEW days ago, when J. P. Morgan, on going from the White House, was asked by a newspaper reporter whether business men were coming to Washington to talk to President Wilson, he replied, "Don't you think we ought to?" The newspaper report says that Mr. Morgan spoke with emphasis, for he was plainly of the opinion that the time had come for business men to talk to the President.

The country will hope that many men will go and tell the President what they think about present conditions. Perhaps they will succeed in instilling into his mind some practical ideas.

The danger is that the President will not appreciate the attitude of the business men who call upon him. Last Saturday, in Philadelphia, in speaking of the enactment of the banking law, President Wilson said that while the bill was pending, "We met with hardly anything but criticism from the bankers of the country." It is true that there was a great deal of criticism, but much of it was of the helpful, constructive kind. Had the crude bill originally introduced been allowed to pass, the effect would have been highly disastrous. Criticism vastly improved the bill. So, let us hope, criticism will improve the so-called anti-trust bills which are now pending in the Senate. At any rate, it is worth while to try to show the senators the objectionable features of the bills.

A fine example of constructive criticism is furnished by the Cleveland Chamber of Commerce, whose directors have just adopted the elaborate report on the Clayton bill of the Chamber's committee on industrial development. The report expresses the conviction that this measure in its present form would put a straightjacket upon American business and would prohibit certain legitimate practices, which may be abused in some instances, but are practical necessities and proper functions of competitive business when properly applied. The report also makes criticisms in detail of the Clayton bill, but it commends some sections and offers helpful suggestions as to amendments, quoting at length from a recent report of the Chamber of Commerce of the United States. Senators will do well to give careful consideration to such reports as those of the Chamber of Commerce of United States, the Cleveland Chamber of Commerce and other organizations of business men drafted after thorough and conscientious consideration of pending bills.

Tested by Hard Times

EVEN a corporation supposed to be soulless sometimes shows its real character to best advantage when adversity comes. To the credit of the United States Steel Corporation be it said that during the depression which has prevailed for some time, making it necessary to exercise rigid economy, the first thought of the officials has been for the employes. Judge Gary, in his recent address to the presidents of the subsidiary companies of the Corporation, outlined the policy which will be followed as to appropriations during the next few months. He warned the presidents that some of them might be disappointed in not receiving recommendations for extensions. "Probably," he said, "you will secure favorable consideration of all recommendations which you may make for expenditures calculated to add to the safety and welfare of your employes." The Judge added that the finance committee would also approve the expenditures necessary to keep properties in condition or to take care of business on the books. But for requests to make extensions like the Canadian plant, which the officials would like to see immediately built, if they could afford it, or for additions to plants which promise large returns, the president of the Corporation would be slow to take action and, if he did, the finance committee would hesitate to endorse it.

In another part of his address, Judge Gary pays a high tribute to the Corporation's workingmen. "No large body of laboring men," says the Judge, "ever treated their employers as fairly and decently as the 240,000 employes of our companies have treated us." Judge Gary tells the presidents that he knows they

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have been sorely tried on account of labor in other countries receiving very much less pay. Present conditions are particularly unfavorable on account of the present laws of the country, which he is generous enough to say were passed because those who voted for them believed they were right and would benefit the largest number. Judge Gary doubtless had uppermost in mind the tariff law. He expresses the earnest hope, however, that wages will not be reduced unless it is imperative to take such action.

In discussing the cause of the present business depression, Judge Gary shows that he has the vision of a big man. He tells of the great destruction and waste of property due to wars, fires and other causes, in different countries, and of the agitation throughout the world, often prompted by good motives, but sometimes due to cupidity or ambition to succeed politically. He expresses the belief that the new tariff law has adversely affected the business condition of the country and says he believes that the policy of the country will be changed to one of reasonable protection. The Judge finds, however, that there is abundant reason for being hopeful and urges the presidents to do everything in their power to restore confidence and prosperity.

One of the strongest characteristics of Judge Gary is his charity in judging the motives of others combined with his insistence that those in high places are under special obligations to guard themselves against being actuated by anything but the best motives. Illustrative of this characteristic is the following striking paragraph:

"There is another thing very important to be considered. It applies to all men of wealth or influence or who occupy positions similar to yours; but it is sufficient now for us to consider the question as applicable to ourselves individually. The undue, the unreasonable, the unjustifiable agitation throughout the world comes partly from a misunderstanding of the facts or from the belief that there is good cause for attacking those who occupy positions of power and influence. No doubt all of us make mistakes, and do things we ought not to do; but there is no excuse, or, if there is excuse, there will be no longer toleration of the individuals occupying positions such as you occupy, if you intentionally wrong any other interests which may be affected by your action or your decisions. If the people of power or influence will consistently avoid giving any just ground for complaint on the part of the great majority of citizens, then in that way and only in that way will the former secure and retain confidence, and so be able to convince the larger number that it is for their interests from every standpoint to co-operate, and thus labor for the success and protection of all."

Judge Gary impresses upon the presidents that they must be true to themselves, to the great corporation which they serve and to the public at large. The address will rank high among the numerous statesmanlike documents which have come from his pen in the past few years.

Whither Are We Drifting?

THE complete control by the national government of railroads provided for in the bill introduced in the United States Senate by Senator Newlands is in harmony with the tendency of recent decisions, particularly that in the Shreveport case, which left very little for the states to regulate in railroad rates. Public opinion unquestionably demands reasonable regulation of the railroads, but it is well to stop now and then and inquire whither we are drifting.

Even Ex-President Roosevelt has discovered that sometimes there is too much control of railroads by governments. In a recent article in the *Outlook*, in telling of his trip to Chile, he said that the railways in that republic are owned by the state, and that the men he met, who were best informed and most trustworthy, expressed great regret that the roads had not been kept in private hands. These men, says Colonel Roosevelt, stated that there was always a deficit in the management of the railways, which were a burden on the government and unprofitable to the citizens generally.

Other countries, particularly Belgium and Switzerland, have recently furnished very impressive evidence of the failure of government ownership. Let us be careful lest we go so fast and so far that government control will merge into government ownership.

Prices Present and Past

Quotations on leading products today, average for last month, average for three months ago and average for July, 1913. Prices are those ruling in the largest percentage of sales at the dates named.

	Today's prices.	Average for June, 1914.	Average for April, 1914.	Average for July, 1913.
Bessemer pig iron, Pittsburgh..	$14.90	$14.90	$14.90	$16.65
Basic pig iron, Pittsburgh.....	13.90	13.90	13.90	15.25
No. 2 Fdy. pig iron, Pittsburgh	13.90	13.90	14.15	14.75
Northern No. 2 Fdy., Chgo.....	14.00	14.25	14.25	15.05
Lake Superior Charcoal, Chgo..	16.00	15.75	15.50	16.75
Malleable Bessemer, Chicago...	14.00	14.25	14.25	14.85
Southern No. 2, Birmingham...	10.00	10.37	10.43	10.45
Southern Ohio No. 2, Ironton,.	13.25	13.50	13.50	14.20
Basic, eastern Pa.....	14.25	14.00	14.25	15.25
No. 2X Virginia furnace.....	12.75	12.75	12.75	13.00
No. 2X Foundry, Philadelphia.	14.75	14.75	15.00	15.50
Ferro manganese, Baltimore....	37.50	38.00	38.50	58.50
Bessemer billets, Pbgh. & Ygn..	19.50	19.75	20.80	26.50
Op. h'th sh. bars, Pbgh. & Ygn.	20.50	20.75	21.60	27.50
Bess. sheet bars, Pbgh. & Ygn..	20.50	20.75	21.60	27.50
Op. h'th billets, Pbgh. & Ygn..	19.50	19.75	20.80	26.50
Steel bars, Pittsburgh.....	1.10	1.11½	1.15	1.40
Iron bars, Philadelphia.....	1.17	1.17	1.22	1.47
Steel bars, Chicago.....	1.28	1.29	1.38	1.58
Tank plates, Chicago.....	1.28	1.28	1.32	1.63

	Today's prices.	Average for June, 1914.	Average for April, 1914.	Average for July, 1913.
Structural shapes, Chicago.....	$1.28	$1.28	$1.35	$1.63
Iron bars, Cleveland, local del'y	1.20	1.20	1.25	1.56
Iron bars, Chgo. mill.....	1.05	1.10	1.15	1.50
Beams, Pittsburgh	1.10	1.11½	1.18	1.45
Beams, Philadelphia	1.25	1.25	1.30	1.60
Tank plates, Pittsburgh.....	1.10	1.10	1.15	1.45
Tank plates, Philadelphia.....	1.25	1.25	1.30	1.65
Sheets, blk., No. 28, Pittsburgh.	1.80	1.82	1.92	2.25
Sheets, blue an., No. 10, Pbgh.	1.35	1.35	1.40	1.72
Sheets, galv., No. 28, Pbgh.....	2.75	2.80	2.92	3.32
Wire nails, Pittsburgh.....	1.50	1.50	1.60	1.70
Connellsville fur. coke, contr...	1.85	1.75	2.00	2.50
Connellsville fdy. coke contr....	2.40	2.35	2.50	3.00
Heavy melting steel, Pbgh.....	12.00	12.00	12.00	12.50
Heavy melting steel, east'n Pa..	10.75	10.75	11.00	11.50
Heavy melting steel, Chgo.....	9.50	9.75	9.50	10.50
Heavy cast, eastern Pa.....	12.50	12.50	13.00	13.25
No. 1 wrought, eastern Pa.....	12.50	12.50	13.00	14.25
No. 1 wrought, Chgo.....	9.00	8.88	8.50	10.50
Rerolling rails, Chgo.....	11.25	11.25	11.25	12.00
Car wheels, Chgo.....	10.75	11.25	11.00	17.00

(For Additional Prices See Page 98.)

Large Transactions in Basic Pig

In the Pittsburgh District—Big Tonnages of Various Grades Pending in the East

The largest purchase of basic pig iron in the open market of the Pittsburgh district the past week was made by the American Steel Foundries, Chicago, for its works at Sharon, Pa., and Alliance, O. This inquiry for 10,000 tons had been in the market for six weeks, being revived every once in a while. The leading valley basic maker captured the business at $13, valley, deliveries to run over the next four months. Immediately thereafter, another sale of 500 tons of valley basic was made at the identical price. But the largest purchase of basic iron made in months, as to tonnage, was closed this week in the valleys, one interest disposing of 20,000 tons to another valley interest. Details of this transaction are closely guarded, although it is known the price was $13, valley furnace, and deliveries extend over last half of the year. It is known this sale was negotiated without formal inquiry having been made in the open market and the suspicion exists that some ore trade is involved in the transaction, for several of such negotiations have been in the air for some days. It is understood the 35,000 tons of pig iron bought by the Wheeling Mold & Foundry Co., of Hickman, Williams & Co., for making its portion of the New York City subway extensions under the East River will come from the valleys. It will be neither straight basic nor foundry grades, and a flat price for the two years' deliveries was made. The statement that the price will be based upon a sliding scale is pronounced erroneous by interested parties to the transaction. So far, the exact price has not been made public. A lot of 2,500 tons of Bessemer was sold by a valley interest a few days ago at $14 for third quarter delivery, the buyer being a manufacturer of steel works equipment in the Pittsburgh district. Several other small Bessemer tonnages have been sold in this territory, none of them running over 500 tons, and $14, furnace, has been the price. Foundry and malleable sales have tapered off the past week, and today the inquiry in these grades includes only tonnages ranging from 100 to 500 tons. No changes in the prices of foundry and malleable grades have taken place.

Hopeful at Cleveland

In the Cleveland district there is a more hopeful feeling among foundrymen and the outlook is more encouraging for a buying movement, but it is not expected that orders for any considerable tonnages will be placed prior to Sept. 1. Iron for delivery in the city is being taken by foundries with very few postponements. Quotations remain at $14.25 for prompt delivery and $13.75 for the remainder of the year, delivered in the city.

Small Tonnages Moving

Sales of pig iron in the Chicago market are characterized by smaller tonnages than usual at this season. Inquiry varying from car lots to 1,000 tons are being received, and most of them eventuate into orders. The total tonnage, however, is not large and melters seem to be taking much less iron than has been their habit in the past. Undelivered tonnage on first half contracts probably accounts for this. The market is still quotable at $14, Chicago furnace, for No. 2 foundry and malleable, but the differentials on higher silicon are not being insisted on with as much firmness as usual. With comparatively small inquiry and contracting, the market is resisting vigorously the tendency toward lower levels and prices at present average higher than was the case during June, although the change is not marked.

Practically no inquiry is being made at Chicago for basic iron and users of this grade appear to be covered for their requirements.

Sellers of southern iron for the

(*For complete prices see page* 98.)

most part are quoting $10.25, Birmingham, for No. 2 foundry and one agent has received instructions to quote nothing less than $10.50, Birmingham, his principal apparently not having much iron for sale. It is believed some iron has been sold in this territory at a price which would figure back to a basis of $10, Birmingham, for No. 2 foundry, but apparently not much has been disposed of on this basis.

Low Prices at St. Louis

Pig iron conditions in the St. Louis market are somewhat improved but prices are low. Southern No. 2 is offered at $10.25, Birmingham, with pretty good indications that a still lower figure could be obtained. Northern iron is quoted at $14, Chicago furnace, and $13, Ironton. Inquiries are in the market for 500 tons of northern coke iron; 350 tons of Lake Superior charcoal iron, and 200 tons of northern coke iron, all for last half delivery. Sales were made last week to a local consumer of 1,000 tons of northern foundry iron, 800 tons of southern No. 2 pig iron and 600 tons of 8 to 9 per cent silicon iron. The same consumer also closed for its requirements for coke, about two cars a month.

Southern Prices Soft

At Cincinnati, the pig iron market is quiet and inquiries before dealers are for small lots, very few exceeding 500 tons. Sales during the past week show a decrease in tonnage over those of last week. Southern furnace iron is now obtainable on firm offers at $10, Birmingham basis, for No. 2 foundry, for prompt or third quarter shipment. In one case it is known that this price has been for the last half. Fourth quarter iron is generally being quoted at $10.50, Birmingham basis, and several sales have been closed recently at $10.25, Birmingham basis, for No. 2 foundry, for last half delivery.

Of southern Ohio furnaces in the Ironton and Hanging Rock districts, only two are in blast at the present time, namely Union and Nellie at Ironton, O., and the former will be blown out about August 1. Southern Ohio furnace iron is $13.50, Ironton basis, for No. 2 foundry but a little resale iron is on the market at $13 and $13.25, Ironton basis.

Fighting Ten Dollar Iron

Pig iron makers at Birmingham report a dull week. No business of any consequence, it is said, has been booked and the weakening in prices hangs on. Ten dollar iron for No. 2 southern is being sold, although in scattered orders. The furnace men have been fighting against $10 iron for the past several weeks. While that price has prevailed on a few sales, the general quotation for third quarter delivery is $10.25 and for fourth quarter it is $10.50. One large operator states that he believes that if furnace men would make a straight out $10 quotation for No. 2, a large buying movement would develop, as he believes that buyers for a considerable time have been withholding orders in the belief that the price would go to $10 and when that is reached, they would at once get into the market.

All orders of Birmingham concerns for the week have been in small lots. The Bessemer furnaces of the Tennessee Coal, Iron & Railroad Co. received an order for 2,100 tons for foreign shipment to Australia. Twenty-nine car loads of the iron have already been started for Savannah. The Gulf State Steel Co. expects to place another furnace in blast at Gadsden within the next week or two.

More Inquiry at Buffalo

The placement for the week by the furnaces in the Buffalo district was moderate. The range of prices has contracted to a spread of less than $1 per ton, with the minimum on No. 2 plain, No. 3 foundry and gray forge being $13 and the maximum on No. 1 foundry $13.75. The inquiry for future needs seems to be more active than it has been for several weeks, and a considerable tonnage is under negotiations. Nothing better than $13 is being offered and some of the furnace interests are holding for better prices.

The melters of the Buffalo district, taken in general, report no improvement in business conditions with them, stating that operations are even below the normal slack level of the mid-summer season. Some of the foundry interests see a shade of improvement and look for more with the opening of the fall season.

Quieter at Philadelphia

Fourth of July distractions have not tended to add much vim to the market, already of modest extent, in eastern Pennsylvania, and sales of pig iron the past week have represented a smaller total as compared with similar recent periods. The general situation manifests no important changes. Prices display softness, especially with regard to prompt iron which the furnaces are offering as necessities dictate, practically at the buyers' own terms. More uniformity is shown on forward metal, though the market reflects few elements of genuine strength. The largest sale of the week involved about 5,000 tons of foundry and special grade iron to the American Car & Foundry Co. for last half shipment to Berwick, Pa., which was divided among Central Pennsylvania and Buffalo makers. A Trenton, N. J., radiator manufacturer took 1,000 tons additional of foundry and a maker of plumbing ware in the same city asks 1,000 tons of No. 2X and No. 2 plain for July-August delivery. Pipe makers in the Delaware river district bought 3,000 tons, including 2,000 tons of northern misfit iron at $13.75, delivered, and 1,000 tons of southern forge at $9.50, Birmingham, or $13.70, delivered. Northern foundry is commanding usually $14.75, Philadelphia, for No. 2X, and this figure is occasionally shaded slightly. Virginia iron shows some variation at $12.75, furnace, for No. 2X and $12.50 for No. 2 plain, equivalent to $15.55 to $15.30, this district, as manifestly these brands are not competitive at these figures. The irregularity seems to be chiefly in prompt iron. No further sales of basic have developed and the market is probably $14.25, delivered, eastern Pennsylvania, though, with the exception of the sale reported last week and involving special features, no transactions have been closed above $14, delivered. In low phosphorus, some additional tonnage has been taken. A Philadelphia steel maker who asked 2,000 to 4,000 tons has covered partially with an eastern maker taking some tonnage of standard and some misfit, at under the prevailing schedule. This same buyer still figures on 2,000 to 3,000 tons of Bessemer. Small sales of standard low phosphorus at $20.50 to $21, Philadelphia, basis and of Lebanon brands at $17 to $17.50, furnace, are noted.

Good-Sized Tonnages Pending

Several good-sized negotiations for pig iron remain under way in the New York City territory and in New England and a number of smaller inquiries are pending. Sales of the past week were lighter, however, particularly in metropolitan territory, which undoubtedly is due in considerable measure to holiday effects. Here and there, evidences of a slight firming up of makers' schedules are to be noted, but the situation shows no conspicuous improvement along that line and softness prevails, especially for early delivery. Reports regarding the Buffalo market are conflicting, but it is well-established that while some makers are holding for $13, furnace, for No. 2X, this level can be shaded 25 cents, probably more, with some sellers. Eastern and central Pennsylvania makers continue to quote at the range of $14.50 to $14.75.

(*For complete prices see page* 98.)

tidewater, for No. 2X. Some sales of prompt central Pennsylvania No. 2X have been made at $15.30, New England, or $13.25, furnace. The Eastern Malleable Iron Co., with several plants in Connecticut and other eastern states, which has been figuring on its last half requirements of malleable, now has brought this matter to an active stage and is expected shortly to close on a block that may reach 10,000 tons, or more. A railway equipment interest is out for 1,000 tons of high silicon foundry for a western plant, 500 tons of the same grade for the New York district and 600 tons of malleable for a New York State plant. A Witinville, Mass., buyer asks 1,000 tons of prompt No. 2X. Other inquiries include 500 tons of No. 2X for a Jersey buyer; 600 tons of No. 1 for a Brooklyn consumer; 500 tons of low phosphorus for Jersey delivery, and other lots. The General Electric Co. has placed orders for about 10,000 tons of foundry iron for Schenectady, Pittsfield and Lynn, and the business is understood to have gone to New York State furnaces. A pipe maker in this district who has been inquiring informally for 5,000 to 7,000 tons for last half has not acted upon this matter, but has taken 1,000 tons additional of low grade eastern Pennsylvania iron. A lot of 1,200 tons of Lebanon low phosphorus iron was placed in the metropolitan district. The recent withdrawal of Wabana, Nova Scotia, pig iron from the American market has nullified additional sales of 15,000 to 20,000 tons of this iron to cast iron pipe makers in the Delaware River district. These sales practically had been closed when the withdrawal was announced.

Coke Buying Decreases

On the Part of Furnaces in the Pittsburgh District —Activity Among Foundry Buyers

The Connellsville furnace coke market in the Pittsburgh district has not lived up to its promise of two weeks ago and buying has dropped off somewhat. Several good sized negotiations, which appeared upon the point of closing some days ago, have been suspended and the suspicion is held by some that at least a portion of this business has gone to West Virginia makers who have not been so stiff in the matter of price as are important producers in the Connellsville regions. Contracting is being held in abeyance by a number of stacks in this selling territory and they are continuing their months-old policy of buying from month to month probably because they are uncertain as to the length of time they will remain in blast. Indeed, no more interested people in the country than coke producers are reading the information in trade papers as to stacks blowing out and planning to blow out in the middle west. In the meantime, while the market is waiting, some furnace coke is being sold in small tonnages and it is bringing from $1.75 to $1.85, ovens, for prompt delivery, while leading Connellsville producers hold out for $2 for contract fuel, and it can be bought down to $1.85, ovens.

But the feature the past week, as well as for the past three weeks, continues to be the foundry coke market. Some contracts have been placed by foundries located just outside the immediate Pittsburgh district, and in some cases, it is understood foundry coke for prompt delivery has been available at $2.25, ovens, and from that quotation up to $2.60, ovens, has been the range. No one large tonnage can be pointed out as having been placed under contract, but the aggregate tonnage has been fair. According to the *Connellsville Courier*, production remained practically stationary in the week ending June 27, being 261,553 tons, while shipments exceeded this by about 9,000 tons.

Quiet at Cincinnati

At Cincinnati the coke market is quiet again after a month of fair activity, during which time about 75 per cent of foundries in the Cincinnati territory which were in the market for coke, contracted for the next year's requirements. It is doubtful whether all of the remaining 25 per cent will cover for the next 12 months, as a number of them at present are buying from month to month to take advantage of concessions for prompt shipment prices. Furnace coke is very quiet, the recent purchase of 45,000 tons of Pocahontas grades by southern Ohio furnaces being the largest transaction on this grade in months.

Coke is very sluggish in the St. Louis market, with 72-hour Connellsville grades held at $2.50 and Connellsville 48-hour furnace grades at $2 to $2.25.

The buying of coke by foundries in the Cleveland district, which started about three weeks ago, continues active. The contracts are in some cases for six months, while other foundries are covering for the full years. The price for last half delivery is $2.50, ovens, but one large interest continues to ask $2.65 for delivery after Jan. 1.

Some Buying in East

Eastern furnaces continue to buy some lots of standard Connellsville coke, usually for quick shipment at $1.85, ovens. A Schuylkill valley maker placed a lot for early delivery on this basis in the week. It is understood in the east that one of the large selling interests, controlling various brands of furnace coke, which has not been willing to do $1.85, for early shipment, now is making this price, though it is quoting higher on contract. The American Locomotive Co. has closed for its requirements of foundry coke, for the year from July 1, for its Dunkirk and Schenectady plants, the maximum quantity of which is estimated at 10,000 tons. The order was divided between eastern by-product and western Pennsylvania beehive coke makers.

(*For complete prices see page* 98.)

Ferro Reduction

Does Not Bring Out Much Business —Small Transactions

German makers of ferro-manganese, who reduced their schedule $1 a ton in the week, to $37, seaboard, have not been able to attract much business by this inducement, inasmuch as the consuming trade in this country is heavily under contract. It is stated that the reduction by the German makers is for the purpose of moving a surplus of product, which has accumulated in makers' hands. English makers have not changed their price of $38, seaboard. Only small transactions continue to be made. Some reports still are current that there has been some shading of prices on 50 per cent ferro-silicon by foreign merchants. This market, however, shows scarcely enough new business to test the true situation.

Much River Coal Waiting.—Hundreds of loaded coal barges are lining the banks of the rivers about Pittsburgh, but with water at a low stage business is at a standstill. Few even of the packet steamers are able to navigate because of the low water. Millions of bushels of coal are awaiting transportation to lower river points. If a rise should come, say river coal officials, one of the largest shipments of fuel made in many years would start south.

Good Production Record Assured

For Tin Plate Mills, But Prices Are Weak—Improvement in Sheet Bookings

Slight improvement in bookings of steel sheets is reported in both the Pittsburgh and valley districts this week. Inquiry also is reported somewhat improved, so that prospects appear better for improved mill schedules, provided inquiry now extant resolves itself into actual orders and specifications. Prices of sheets appear to have undergone no change, nor is improvement in that regard expected until some rather hungry mills have been filled, which may require some time at the present rate.

The formal signing of the sheet mill wage scale of the Amalgamated Association of Iron, Steel and Tin Workers last Friday in the Fort Pitt hotel meeting at Pittsburgh was agreed to by a number of independent mills in the central west. After long discussion, it was agreed by both manufacturers and employes to waive demands previously put forward at the last Atlantic City conference, the men's demand being for wage increases which would amount to about 14 per cent, this being accomplished through the medium of footnotes. The final decision favored agreement on last year's scale basis, practically.

Tin plate mills in the Pittsburgh district are running at a rate that will insure 1914 being regarded as a good year as to tonnage output. The tin mills of the American Sheet & Tin Plate Co. are being operated at 93 per cent of capacity, with good prospects for continuance of this rate until late into the autumn. While practically all this tonnage was placed last November and December, some small buying is being done and prices are low for prompt business. Several new mills have been placed in operation since the main tin plate tonnage was placed, and, being anxious to get business, they have been making strong bids for orders which established competitors have been obliged to meet. It is certain that $3.30 per 100-pound box now is the top of the present market, while some makers are taking business even at $3.25 per box. In some sharply competitive business, as low a price as $3.10 per box has been heard of, but this latter price has not been entirely confirmed. It is a soft tin plate market, however, that makers now are facing. Good reports continue to be heard from the canners, for, while the peas crop was not large, prospects are good for a fine pack of corn and tomatoes, which always is a larger canning prospect than peas. Canners figure they will have a better year this season than in several past, which augurs well for the tin plate market for the rest of the year from the tonnage standpoint. This year the tin plate output is a bit better than usual, which confirms the opinions of tin plate market experts that no matter what the general condition of the times, the tin plate market is a law unto itself.

Mills Operating Again

The American Rolling Mill Co. has re-opened its two plants at Middletown, O., and is again running full in all departments. Another large maker is still closed for alterations and repairs and another did not run last week, but is operating again this week in full. The sheet market is holding its own and is more satisfactory than at the same time in June. Orders are generally for small tonnages, but the aggregate is fairly large. Black sheets No. 28 gage are quoted at from 1.90c to 2c, galvanized No. 28 gage at from 2.85c to 2.95c and blue annealed No. 10 at 1.55c, all Cincinnati basis.

Sheets Have Better Tone

While there has been no advance in the quotation on steel sheets in the Chicago market, the sentiment is decidedly better and as soon as more tonnage is booked, prices may stiffen somewhat. Several smaller mills, which have been selling in this territory at unusually low prices, apparently have filled themselves up for several weeks ahead and are no longer contending for business in this vicinity at the same level they have maintained previously. Mills which have been conservative in their quotations believe the time is ripe for them to take the tonnage at better prices than have been made and they expect their tonnage to be increased.

Quotations now are on a basis of 1.98c to 2.03c and 2.93c to 2.98c, Chicago, for black and galvanized sheets respectively.

German Makers Take Sheets

Makers in eastern Pennsylvania quoting upon a good-sized order for No. 14 gage blue annealed sheets for a Montreal buyer lost the business to German mills at 1.40c, delivered. This price is $4 a ton below the lowest price sheet makers in this country yet have made, which allowed them little or no profit. Prices similar to that at Montreal are understood to have been quoted by German makers at New York. The eastern market in sheets is not active and the leading maker is resuming only partially this week after the holidays. Eastern makers are inclined to hold as minimum 1.50c, Philadelphia, or 1.35c, Pittsburgh, for No. 10 gage blue annealed.

Low Prices at Cleveland

In the Cleveland district there is keen competition on sheets and some very low prices are made. On a sale of about 200 tons of galvanized sheets of sizes calling for large extras, the price of 2.65c, Pittsburgh, was made.

(*For complete prices see page* 98.)

Wire Products

In Moderate Demand—Better Feeling at Pittsburgh

While the amount of new tonnage of wire products actually being placed on makers' books in the Pittsburgh district has not increased appreciably the past week, yet manufacturers of all sorts of wire products report finding a better feeling on the part of buyers. However, this inclination to cheerfulness has not been translated into actual orders, nor is it expected to be so translated for several weeks. Buyers seem willing enough to admit that $1.50 for nails is cheap enough for anybody, but also add they are not yet ready to buy. Plain wire still holds to $1.30 for fencing purposes, while for manufacturing further it is bringing $1.35, all Pittsburgh basis.

Wire May Advance

New York, July 8. (By wire.)—An advance of $1 in wire products is expected to be announced in the near future. Considerably more contracting for wire products is being done and this market shows general improvement.

The Illinois Central railroad is taking bids for 10,000 underframes and also is asking bids on material from which they may be fabricated in their own shops. These underframes are to be used in cars already in service and represent about one ton to each underframe.

Deadlock on Steel Bars

Mills Resist Efforts of Agricultural Implement Manufacturers

The efforts of agricultural implement manufacturers to contract at low prices have encountered strong opposition from the mills. The result is that there is a deadlock at the present time and further developments are awaited with interest. On the inquiry for 700 tons of steel bars for immediate shipment to a Toledo manufacturer, the mills positively refused to shade 1.10c, Pittsburgh, and that price was finally paid. It is probable that in some cases in which the buying of bars is accompanied by the placing of orders for other materials, some concessions are made, but the mills are steadfastly refusing to knock off extras, except for twisting of reinforcing bars. The prevailing quotations are still 1.10c, Pittsburgh, for prompt delivery, 1.15c for delivery up to Jan. 1 and 1.20c for delivery after Jan. 1. In the case of contracts made for delivery after Jan. 1, buyers are protected against decline below 1.20c. These contracts are, however, made very reluctantly by the mills.

Contract For Bars in East

Some of the eastern Pennsylvania implement makers now have closed contracts for steel bars for last half at 1.30c, delivered, or 1.15c, Pittsburgh. Two buyers took about 1,000 tons each on this basis and another is in the act of closing for 500 to 600 tons. The business went to western Pennsylvania and Ohio makers who declined to make this price apply beyond July 1. The Wilkesbarre consumer figuring on 15,000 to 20,000 tons of axle bars may close this week. The addition to the Hotel Traymore, Atlantic City, as planned, will require about 1,000 tons. Specifications continue better. Prompt bars could probably bring 1.25c, delivered, or 1.10c, Pittsburgh, but the minimum of the forward market appears to be 1.15c, Pittsburgh.

Eastern Implement Buyers Close

The two leading implement manufacturers in eastern New York now have placed their steel bar requirements for the year beginning July 1, aggregating 15,000 to 20,000 tons. The business was distributed among several makers in the Pittsburgh district. Smaller buyers also are placing some contracts in metropolitan territory. The usual contract prices being made are 1.15c, Pittsburgh, for last half and where beyond Jan. 1 is covered, an advance of at least $1 a ton is asked. New bar business in the New York district is heavier and specifications also are better.

More Pittsburgh Inquiry

Little new tonnage is being figured in plates in the Pittsburgh district, and the same is true of structural material. In the past few days, however, more genuine inquiry for steel bars has come into the market, this from implement makers who now seem to be somewhat more inclined to believe bottom actually has been struck at 1.10c, Pittsburgh. Nothing is being done at less than this price by any maker in the Pittsburgh territory, this being ascertained by persistent and patient inquiry. Considerable tonnage continues to be taken at 1.15c, Pittsburgh, and cases are heard of 1.18c, Pittsburgh, getting the business in small tonnages, although these last named cases are rare. If all the bar tonnage now out in inquiry be placed it will be warmly welcomed by the mills, although they now stand with their backs to the wall on price, refusing to shade 1.10c.

No Activity in Steel Bars

Steel bars in the Chicago market present practically the same aspect as for the past fortnight. Quotations of 1.28c to 1.33c, Chicago, represent the market for contract business. Bookings are being made here and there for last half delivery at the minimum and first half delivery at the maximum. Some unusually attractive prompt business has gone at 1.25c, Chicago, but this has not run into much tonnage.

Agricultural implement makers are still standing pat and comparatively few contracts have been made either for the immediate six months or the first six months of 1915. Mills continue firm in their determination to accept contracts for a year only on the basis of an advance for the second six months.

Iron Bars Still Weak

The iron bar market in the Chicago district has not strengthened materially, although the closing of several mills for summer repairs and to await the settlement of the wage question with the Amalgamated Association has given it a somewhat firmer tone. Bars are quotable at 1.05c to 1.10c, Chicago, although some mills outside this immediate district have made a quotation of 1.00c on some unusually attractive business. However, this quotation is less in evidence now than a short time ago and business is being booked all the way up to 1.10c, Chicago.

A Buffalo office booked an order in the interior of the state for 5,000 to 6,000 tons of bar materials. The general feeling in this and the other lines at Buffalo is that prices have gone as low as they will before a turn is noted and a stiffening follows. An increasing number of buyers are covering for their requirements. The price range on bars, applicable also to plates and shapes, is 1.10c, Pittsburgh, on favorable quantities and prompt specifications, and 1.15c for third quarter, while 1.20c is being generally asked for fourth quarter needs.

(*For complete prices see page* 98.)

Sheet Bars

Develop Decided Weakness — More Billets Are Moving

Small lots of billets are changing ownership in the Pittsburgh district at the ruling market quotation of $19.50 to $20, Pittsburgh and Youngstown, but the tonnages are not large. However, the larger makers of billets and sheet bars find their mill tonnages moving at about the rate of the preceding week, which was a considerable improvement over May. Some of the smaller manufacturers of sheet bars are beginning to show somewhat more anxiety to sell for prompt specifications, and at least one lot of 1,500 tons was offered a consumer in the Greater Pittsburgh district at $19, delivered buyer's mill. This offer was made solely for immediate shipment of the total tonnage and no contract extending over any period would be accepted at that price or even under the ruling market figure, which is $20.50 to $21, Pittsburgh and Youngstown. This shows, however, a softer tendency in the Pittsburgh sheet bar market, which as yet has not crystallized.

Ashland Steel Closed

The Ashland Steel Co., Ashland, Ky., has again closed for repairs and will not be in operation for several days. Billets and wire rods are very quiet and the situation shows no change. Wire rods are quoted at $25 and billets at $20, both Ashland basis.

Billet Buyers Not Contracting

New billet business is coming slowly to the mills in eastern Pennsylvania, as consumers show small disposition to contract. One eastern maker, however, reports itself well booked for third quarter. The larger sellers in the east are quoting rolling billets at $21.90, Philadelphia, or $19.50, Pittsburgh, and forging billets at $25.90, Philadelphia.

More Inquiry for Scrap

In Some Districts But The Market Still Drags

Heavy melting steel, turnings and borings in the Buffalo district have come in for an increased amount of inquiry in the past week. The dealers are not booking all offers, however, as they do not seem to be satisfied with the prices accompanying the inquiries. Most of the sales of the various lines are in small lots. The dealers seem to feel that better prices will soon prevail. Price changes announced late Tuesday afternoon are: Stove plate, net ton, $9.25 to $9.75; low phosphorus steel scrap, $14 to $14.50; old iron rails, $13 to $13.75; No. 1 railroad wrought scrap, $10 to $10.50; old steel axles, $12.50 to $12.75; old iron axles, $19 to $19.50.

The old material market in the New York district remains sluggish. Trading is for close-by delivery and needs, as the consumers seem anxious to bring the dealers and brokers to sell at ruling prices. New business is light. Prices fluctuate narrowly.

Sluggish at Pittsburgh

Iron and steel scrap is moving sluggishly in the Pittsburgh district. Some of the larger users of heavy melting steel refrain from buying, as they have fair sized stocks on hand. Some users have been able to get small heavy steel tonnages around $11.50 because of some material being on track and it was not desired to reship it. The latest Pennsylvania railroad scrap list for the Pitcairn yards went at about $12 delivered Pittsburgh, the tonnage including about 400 tons. Borings and turnings appear to be the most active grades just now. Rolling mill scrap is at its lowest ebb.

More Interest But Little Buying

There is no improvement in volume in the old material market in eastern Pennsylvania. Consumers are manifesting a little more interest, which is expected to bring better sales later, but this development has not appeared to date. The larger consumers, including the eastern steel makers, still have some orders outstanding which they now are taking out more slowly because of stocks accumulating. One mill has upwards of 20,000 tons in its yard. June railroad lists brought better prices, around $11, delivered, for heavy melting steel and $11, delivered, for car wheels. Sales of about 1,000 tons of first grade low phosphorus have been made to steel foundries at $14.50, delivered.

Demand is gradually falling away and there is very little material moving. The American Rolling Mill Co. has reopened its two plants at Middletown, O., but this will not help the iron and steel scrap market as an embargo has been declared against shipments to this company. Other large consumers in this territory have closed down, some for alterations and repairs and others because of the lack of business. Many local foundries are barely operating. Prices are unchanged, principally because transactions have not been of sufficient importance to form a basis of comparison.

No Change in Scrap

The scrap iron market in Chicago is marking time at its lowest point. Demand, already dull, has been further curtailed by numerous shutdowns for summer vacation and repair and almost no tonnage is moving. Prices remain nominally at the same level as has prevailed for several weeks and dealers are stacking their accumulations in the hope of better prices later. Railroad tonnage continues to come out and a number of lists are now before the trade. The Frisco Line offers 1,500 tons; C. M. & St. P., 2,200 tons; the Wabash, 850 tons; Standard Oil Co., 425; C. P. & St. L., 400 tons and the Mobile & Ohio, 415 tons.

Improvement at St. Louis

Scrap conditions are somewhat better in the St. Louis market, and dealers are willing to speculate on prices offered today, believing that July and August will show marked improvement because of the flattering prospects for big crops. Lists out today are: Vandalia Railroad Co., 500 tons; Baltimore & Ohio, 8,000 tons; Great Northern, 1,500 tons; Mobile & Ohio, 1,200 tons; C., P. & St. L., 400 tons; Wabash, 1,200 tons; Frisco, 1,500 tons.

Inquiry for Steel Pipe

Inquiry for steel line pipe continues to come out in the Pittsburgh market, one in particular attracting some attention the past week. This is an inquiry for 54 miles of 16-inch line pipe which will be shipped to Arkansas gas fields. This would amount to 7,000 tons of pipe, which would make an interesting order in these times. However, while figures have gone in on this inquiry, yet the proposition is considered tentative.

(*For complete prices see page* 98.)

Chicago Lettings

Make a Good Total — Moderate Improvement in the East

Structural contracts in Chicago territory the past week give a total of nearly 13,000 tons and the several projects are for larger individual tonnages than have been the rule the past month. The largest letting is the pier house for the municipal pier in Chicago, which was reconsidered by the municipality and now has been placed with E. L. Scheidenhelm. The steel, 8,500 tons, has been awarded to the South Halsted Street Iron Works. This is an unusually attractive piece of shop work, as it is largely duplicates and can be handled with much economy. The tonnage includes about 1,500 tons of steel bars.

Other lettings are fairly well scattered and include the fifth section of the Crane Co.'s new plant and the Webster avenue bridge in Chicago.

In the Cleveland district a number of buildings of importance are being planned and the outlook is more encouraging, but the volume of business recently transacted is very small.

Improvement at New York

A moderate improvement in new business in structural shapes in the New York district is reported by makers. The number of small requirements, which has been very fair in recent months, has increased and some consumers show greater confidence in placing orders to rebuild depleted stocks. One stock order of more than 1,000 tons, went to an eastern Pennsylvania mill. Larger sized lettings are not so plentiful, but a good tonnage remains in prospect. Prices are so low that they now show little variation from recent levels and range from 1.26c to 1.31c, New York.

Eastern Mills not Gaining

About all that may be said of the structural shape situation with eastern Pennsylvania mills is that the tonnage is holding its own at the recent fractional rate. The Bethlehem Steel Co. appears to be in good position on bookings and specifications, but other eastern makers are not so fortunate. New business is largely of small requirements. In Philadelphia, however, about 11,000 tons for municipal piers and a power house are open. The low level of the market generally is 1.25c, delivered for early delivery, though it is reported that lower sometimes is done. For more extended shipment, 1.15c, Pittsburgh, is quoted.

The Roche Bruner Building Co., Cincinnati, has received the general contract to build the new high school at

Hamilton, O., the contract price being $213,894. The steel required, including structurals, re-inforcing bars, plates, shapes, etc., will amount to about 3,000 tons. No sub-contracts have been let.

The fiscal court of Henderson county, Ky., has awarded contracts for 12 steel bridges according to plans and specifications of the Champion Bridge Co., of Wilmington Del. H. H. Lilly and Roscoe Hay, Henderson, Ky., and the Vincennes, Ind., Bridge Co. got the contracts for the construction work.

CONTRACTS PLACED.

Steel piling for construction work at Kiskimenitas Junction, Pa., 250 tons, awarded Jones & Laughlin Steel Co.

Onondaga Hotel, Syracuse, N. Y., 1,000 tons, awarded the John Eichleay, Jr. Co.

Garage on East Seventh street, New York City, for the Automobile Club of America, 700 tons, steel erection awarded Post & McCord, and fabrication will be done by American Bridge Co.

Chesborough building, State and Whitehall streets, New York City, 1,200 tons, awarded Levering & Gerrigues.

Building for Ward Motor Vehicle Co., Mount Vernon, N. Y., 250 tons, awarded the McClintic-Marshall Co.

Manual training school, Pratt Institute, Brooklyn, 200 tons, awarded Hedden Iron Construction Co.

United Charities building, East Twenty-second street, New York City, 200 tons, awarded American Bridge Co.

Catholic school in Brooklyn, 200 tons, awarded American Bridge Co.

Addition to Bonwit, Teller & Co. store, Fifth avenue, New York City, 2,000 tons formally awarded to American Bridge Co., as previously indicated.

Section No. 7 of the Seventh avenue subway line, New York City, 3,800 tons, awarded American Bridge Co., by general contractors, the Rapid Transit Construction Co.

Building for Tissue Co., Saugerties, N. Y., 400 tons, awarded Pittsburgh Bridge & Iron Co.

Highway bridge for New York State at Bethlehem, N. Y., 450 tons, awarded Penn Bridge Co.

Bridge for Long Island railroad, 200 tons, awarded McClintic-Marshall Co.

Pier shed, city of Chicago, 8,500 tons, to the South Halsted Street Iron Works, Chicago.

Crane Co.'s Corwith plant, fifth section, Chicago, 1,406 tons, to the Vierling Steel Works, Chicago.

City of Chicago, Webster avenue bridge, 1,188 tons, to the Modern Steel Structural Co.

Illinois Traction Co. terminal building, Peoria, Ill., 498 tons, to the Decatur Bridge Co., Decatur, Ill.

Addition to Lincoln High School, Seattle, Wash., 338 tons, to the Seattle Construction & Dry Dock Co.

Oakland, Antioch & Eastern Ry. Co., steel hull for Trans-bay Ferry Boat, 300 tons, to Pacific Rolling Mill Co., San Francisco, Cal.

Cory office building, Fresno, Cal., 240 tons, to Palm Iron Works, Los Angeles, Cal.

Snohomish county, Oregon, one 308 feet, P. C. span, near Monroe, Wash., 202 tons, to the American Bridge Co.

Alhambra Theater, Ogden, Utah, 200 tons to the Modern Steel Structural Co., Waukesha, Wis.

CONTRACTS PENDING.

Municipal piers, Philadelphia, 6,000 tons, bids to be received July 16.

Highway bridge over Susquehanna river, Nanticoke, Pa., 900 tons. Revised bids being taken.

United States Immigration Station, Boston, 600 to 700 tons, Geo. A. Fuller Co. awarded general contract.

Building for the First National Bank, Durham, N. C., 300 tons, bids received.

Subway terminal building, Newark, N. J. Revised figures show steel tonnage is 9,360 instead 7,000, as previously stated. Bids to be taken July 11.

Addition to Hotel Traymore, Atlantic City, estimates now being taken on all-steel construction, as well as concrete construction, which originally was designed. If all-steel used, 3,000 to 4,000 tons will be required.

Section No. 5 of the Broadway-Fourth avenue subway extensions, New York City, 3,430 tons. Bids to be received July 24.

City hall, Pittsburgh, plans being drawn, about 10,000 tons.

Diamond market house, Pittsburgh, steel tonnage not determined.

Benedum & Trees building, Pittsburgh, addition, steel tonnage being figured.

Hamilton high school, Hamilton, O., 3,000 tons. General contractors, the Roche-Bruner Building Co., Cincinnati, O.

Outlook Much Improved

Important Inquiries For Cars Expected Soon—Pennsy Distributes Its Rail Tonnage

New York, July 7.—An improved outlook for equipment buying by the railroads is presented and there is good authority for the expectation that inquiry for fully 10,000 additional cars will be put out within the next several weeks by systems with headquarters in this city. Some of these cars will be for the Southern Pacific, the contemplated purchase of which already has been referred to. Another eastern road is about to inquire for 4,000 cars, and the New York Central system has 2,000 additional in view for the Toledo & Ohio Central. Other car inquiries now pending total about 4,000. This week the Delaware, Lackawanna & Western railroad placed 300 box cars with the American Car & Foundry Co., 250 box and 200 automobile with the Pressed Steel Car Co., 200 mine cars to the Magor Car Co. and has put out a new inquiry for 500 gondolas.

The Illinois Central is planning the strengthening of 10,000 cars and now is in the market for 7,000 tons of angles for that purpose.

Pennsy Rails Distributed

The Pennsylvania railroad formally has distributed the remaining 100,000 tons of its 1914 rail order. The division is about as previously outlined and gives the United States Steel Corporation mills 44,000 tons; Pennsylvania Steel Co., 22,000 tons; Cambria Steel Co., 22,000 tons; the Bethlehem Steel Co., 6,000 tons, and the Lackawanna Steel Co., 6,000 tons. All these orders are for 100-pound sections, with the exception of 5,000 tons of the Pennsylvania Steel Co. order, which is of 120-pound sections. While the Pennsylvania railroad has asked for bids to be submitted by the respective mills upon their allotments, this is the usual method adopted by this system, and is regarded by makers as a mere formality. This year, however, the tonnages were made more exact in the case of each mill. The Boston & Maine railroad, which recently placed 5,000 tons of rails with the Pennsylvania Steel Co., has divided 5,000 tons additional between the Bethlehem Steel Co. and the Lackawanna Steel Co. The Central of Vermont has given 2,000 tons to the Bethlehem Steel Co. The Clover Leaf now is in the market for rails. In export, Cuba is asking for 1,000 tons.

The Seaboard Air Line has placed 6,000 kegs of spikes with a Virginia maker and considerable other spike business remains in the market. A new inquiry calls for 1,300 kegs for Stone & Webster for Texas delivery.

Taking Bids on Underframes

The Illinois Central railroad is taking bids for 10,000 underframes and also is asking bids on material from which they may be fabricated in their own shops. These underframes are to be used in cars already in service and represent about one ton to each underframe.

CAR AND LOCOMOTIVE ORDERS.

The Chicago, Milwaukee & St. Paul Railway has ordered five superheater freight locomotives from the American Locomotive Co.

The Southern Pacific railroad is inquiring for 30 locomotives.

The Chicago Street Railways Co. is inquiring for 228 coaches.

(*For complete prices see page* 98.)

Low Prices on Tubes

Boiler tubes are now selling at the lowest prices that have prevailed during the last 17 years. The lowest price recently made, 74, 5 and 5 off, is equivalent to 12.9 cents per foot, which compares with 10.8 cents per foot, which was made 17 years ago, when the price of steel billets was lower by $5 than at present. The prevailing price at present is 72, 5 and 5 off, or 13.9 cents per foot.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

Edward S. Black, mechanical engineer of the Edgar Allen American Manganese Steel Co., is a newly elected member of the American Iron and Steel Institute. Mr. Black was trained as a machinist in a marine works and in the shops of the Chicago, Rock Island & Pacific railroad. After a full apprenticeship, he went to the Chicago Bolt & Nut Co., now a part of the American Bridge Co., and took charge of its machine shop. From there he returned to the Rock Island shops as assistant chief draftsman and a year later occupied the position

EDWARD S. BLACK,
New member American Iron and Steel Institute

of chief draftsman for the Rock Island. From there he went to the Fraser & Chalmers Co., now the Allis-Chalmers Mfg. Co., as designing engineer and designed Corliss engines and pumping machinery. His next move was to go into business for himself at Blue Island, building engines, boilers, etc. He closed up this business in 1893 and went to the Gates Iron Works as inspector of material. Later he associated himself with Hoover & Mason as constructing engineer and remained with them 12 years, during which time he designed and installed all of their ore handling equipment throughout the country. He went to the Edgar Allen company three years ago.

W. E. Davis, formerly with the H. W. Johns-Manville Co., Chicago, has been appointed sales manager of W. A. Blonck & Co., Fisher building, Chicago. The Blonck company manufactures boiler efficiency meters.

Charles J. Harrah, president of the Midvale Steel Co., Philadelphia, has sailed for Europe.

L. H. Shoemaker has been appointed division engineer at Pittsburgh of the American Bridge Co., to succeed Richard Khuen Jr., transferred to the erecting department. Mr. Shoemaker was graduated at the University of Michigan.

W. A. Comstock has been elected president of the Cleveland Wire Spring Co., Cleveland, to succeed the late R. C. Moodey. Other officers were elected as follows: E. S. Page, vice president; J. W. Campbell, secretary and treasurer, and E. L. Farrow, assistant secretary and treasurer.

Major R. W. Leonard has resigned his position as commissioner of the National Transcontinental Railway, owing to the near completion of the railway. Under recent legislation, Hon. Frank Cockrane, Canadian minister of railways, is empowered to exercise the power of the commission and the work will be completed under his immediate supervision.

W. H. Osborne, who recently resigned as head of the gas construction department of Riter-Conley Mfg. Co., Pittsburgh, was given a complimentary dinner Monday night at the University Club, by executives and departmental heads of the company. He has been connected with the company for 18 years and leaves to become vice president and general manager of the Lowell Gas Light Co., Lowell, Mass.

Arthur F. Braid has resigned from his position of metallurgical engineer with Goldschmidt Thermit Co. and has purchased an interest in the Walker Starter Co., Lacon, Ill. Mr. Braid will be actively associated with the Walker company as sales manager in the Cleveland district; he is also a member of the board of directors. This company has a temporary plant which it is operating at full capacity and the management is looking for a suitable site for the permanent plant which will include a foundry, machine shop, etc.

Mark C. Steese, formerly superintendent of the Grace furnace, of the Brier Hill Iron & Steel Co., Youngstown, O., resigned, July 1, as superintendent of the mechanical and electrical department of the same company. Several hundred employes presented him with a gold watch, chain and charm.

Brent Wiley, commercial engineer of the Westinghouse Electric & Mfg. Co., at East Pittsburgh, Pa., was recently elected a member of the American Iron and Steel Institute. Mr. Wiley graduated from Rose Polytechnic Institute, Terre Haute, Ind., in electrical engineering, in 1908. He was associated with the Carnegie

BRENT WILEY,
New member American Iron and Steel Institute

Steel Co. at its Youngstown and Homestead works for a period of six years as assistant to the electrical engineer at these plants. Subsequently, Mr. Wiley became associated with the Wellman-Seaver-Morgan Co., at Cleveland, as electrical engineer. While engaged in this work, the majority of applications of electrical apparatus coming under his supervision included various classes of machinery necessary for the operation of iron and steel plants. For the last eight years, Mr. Wiley has been associated with the Westinghouse Electric & Mfg. Co. as commercial engineer, specializing on and having charge of the sales of apparatus manufactured by this company for use in iron and steel mills as well as similar industrial plants.

Southern Furnaces Win a Victory

Interstate Commerce Commission Reduces Rates From Birmingham to Numerous Points—Comment From Leading Centers Affected

The struggle between the blast furnace interests of the south, aided by foundrymen in other sections of the country and opposed by railroads and competing furnace interests of the north, has resulted in a decision of great importance by the Interstate Commerce Commission, making a reduction of some rates as prayed for, but not to the extent requested, while on other rates no action was taken.

As the decision was announced, it was understood that the $3.25 rate from Birmingham to Cincinnati was not changed, but THE IRON TRADE REVIEW is authoritatively informed that the rate to Cincinnati will be $2.90. The first announcement from Washington that the Cincinnati rate had been unchanged was received with much surprise and considerable indignation in the Cincinnati market.

Whether the decision will be accepted without protest by the railroads and others interested, is not known. It is possible that an appeal will be taken to the courts.

Washington, July 7. (By wire.)—Holding that rates on pig iron from Chattanooga, Tenn., and Birmingham, Ala., districts are unreasonable, the Interstate Commerce Commission this morning handed down a decision in the case of the Sloss-Sheffield Steel & Iron Co., and other makers, ordering reductions throughout the affected territories, new rates to become effective on Aug. 15. Rates from Chattanooga were made on differentials under Birmingham and that relationship is maintained and, therefore, by using the reductions ordered from the Birmingham district the result of the order is readily recognized. The reductions range from 35 cents to 85 cents a ton.

The decision orders the rate to Louisville, Ky., reduced from $3 a ton to $2.65; to St. Louis from $3.75 to $3.40; to Chicago from $4.35 to $4, all these being all-rail rates; to Boston, rail-and-water, from $4.60 to $4.25; to Springfield, Mass., and Portland, Me., rail-and-water, from $6 to $5.25; to Lowell, Mass., from $5.85 to $5. Like reductions are prescribed to other interior New England points. It is ordered also that the all-rail rates from Birmingham and Tennessee districts to Ohio river crossings not covered in the foregoing and to points east thereof, and rail-and-water rates and rail-water-and-rail rates to other northeastern points shall bear the same relation to the pig iron rates here fixed from the Birmingham district as at present exists.

Present differentials between southern furnaces are ordered maintained as is also the relation of rates now obtaining to the Ohio river, to points in Central Freight Association territory and to the east. The decision says sufficient testimony has not been presented upon which a definite ruling with respect to all-rail rates to New England can be made. As to the reasonableness of present differentials between all-rail and rail-and-water rates no opinion was expressed, in the opinion, but it was said the fact nothing was pointed out must not be taken as justification for any increase in such differentials. With this understanding, the readjustment of the all-rail rates to New England is left to the carriers. The award of reparation prayed for should be denied, the opinion says. The commission says it does not think it fair to group all of New England points at port rates, as it was requested to do by complainants.

History of the Case

Washington, July 7.—Pig iron makers of the Alabama and Tennessee districts, largely represented by furnaces in the Birmingham, Ala., and Chattanooga, Tenn., districts, feeling that they were being discriminated against in favor of northern furnaces, filed a complaint with the Interstate Commerce Commission, asking for a reduction of rates to Ohio and Mississippi river crossings and beyond to Chicago and St. Louis, and other points in the west and northwest as well as to Baltimore, Philadelphia, Providence, R. I., Boston, and interior points in New York and New England, both all rail and rail and water. In addition to the rates asked, as indicated by the accompanying table, the complainants, who also asked for reparation, sought a rate not to exceed $5 to interior New England points. Present rates from Birmingham to points not named in the table, follow:

To Providence, all rail, $6.40; rail and water, $4.60; Baltimore, all rail, $4.50; rail and water, $3.85; New York, all rail, $6.15; rail and water, $4.25; Philadelphia, all rail, $5.20; rail and water, $4.

Rates from Chattanooga, as indicated in a footnote to the table on the following page, are, generally, from 25c to 35c per ton less than from Birmingham. It was set out in petitions of complainants that, with the establishment on April 1, 1907, of the rate of $3.25 from Birmingham to Cincinnati, when the price of Birmingham iron reached the high mark of $26 per ton, the railroads abandoned their previous practice of making rates in accordance with iron prices as had been done by an agreement, put into effect May 1, 1897, when the rate was established at $2.25. It remained at that figure till Feb. 6, 1899, when it was increased to $2.75, because of the increase in the iron price, and it was further increased to $3.25 on June 21, 1899. Then it slumped to $2.75 again on Sept. 1, 1900; went up to $3.25 on Sept. 15, 1902; down to $2.75 once more on Feb. 1, 1903; up to $3 on March 1, 1906, and then to $3.25 on April 1, 1907.

During the fiscal year ended June 30, 1911, it was pointed out in complainants' petition, there was shipped from the Birmingham district by rail lines 943,564 tons of pig iron. Of this, it was contended, only 78,539 tons, or about 8 per cent, went to interior southern points. It was added further that of the shipments from all of the Alabama and Tennessee districts, about 8 per cent was shipped to interior southern points and the argument was made that as much as 80 per cent of the product must be marketed on and north of the Ohio river and in the east in order to enable the industries in the south to survive. It was claimed that competition to a large extent was defeated and the movement of the traffic greatly retarded the industry in the south, causing serious loss and injury to those dependent upon the furnaces' activity. Of the 21 furnaces in Tennessee, the petition (April 16, 1912) only six were in blast. In Alabama, it was claimed, 29 furnaces were idle and 21 in blast.

Founders generally in the north, west, east and other points to which the southern pig iron makers said rates

were unjust intervened on behalf of the complainants, holding that the rates should be reduced. On the other hand, competing furnace interests throughout the affected sections intervened on behalf of the railroads, and made the general contention that, if the rates from the southern districts were reduced, those from the competing centers should also be lowered. It was genarally conceded that the rates from southern districts per ton-mile were higher than from competing centers of the northern and other sections, but it was strongly maintained that this was entirely within economic laws and sound railroad rate making, inasmuch as the density of traffic from competing centers of the northern and other districts was far greater. Idleness of furnaces in the south which was complained of, was ascribed to the law of demand and supply. The railroads maintained the rates were not unreasonable and that in order to preserve the relationship, they should not be changed.

The hearing in the case, which is represented by about 3,500 typewritten pages and many exhibits began before Commissioner McChord in Washington on Nov. 7, 1912, and the principal hearing ended Nov. 16, 1912. Oral arguments were made on Feb. 8, 1913.

Chicago Opinions Vary

Chicago, July 7.—Opinions as to the probable results of the reduction of 35 cents in the freight rate on southern iron from Birmingham to Chicago and vicinity are divided. One producer of northern iron who has high phosphorus iron among his products states his belief that the railroads which derive a large revenue from transporting this iron will meet the southern reduction by at least 25 cents and readjust rates to help the pig iron producer in the north in meeting the competition of makers in the south.

Another maker whose furnaces produce a high phosphorus iron in competition with southern irons believes that in the present situation a reduction of 35 cents in the rate from Birmingham to Chicago will not open the gates wide and that users of northern high phosphorus iron will not be tempted to change their mixture even though southern iron might be offered them at a slightly lower price than northern.

On the other hand the delivered price of southern iron and northern iron in this market usually is close and a change of a few cents one way or the other often will bring them to an equivalent. Northern makers express themselves as very decidedly of the opinion they will not allow southern iron under any circumstances to enter this market and take away their local business. From this it is gathered they will make a price which will retain the home market for themselves under the same circumstances as exist now.

Brokers dealing in southern iron believe the reduction of 35 cents will not be sufficient to give them much advantage in this territory and say they would need 50 cents to 75 cents reduction in order to compete successfully with northern makers.

As the situation stands on the prices which have obtained through most of the first half of this year, northern iron has been selling at $14 to $14.25, Chicago furnace, equivalent to $14.50 to $14.75 delivered in Chicago and within the 50 cents freight radius. Southern iron has been quoted at $10.25 to $10.50, Birmingham, which is equivalent to $14.65 to $14.90 delivered Chicago. This difference in delivered prices has been sufficient to shut out southern iron almost entirely and the market has been retained by northern makers for their own products.

The pig iron situation in this vicinity has been growing more and more into a local affair and southern pig iron has been excluded more and more as conditions have tightened. One broker who formerly disposed practically of 200,000 tons per year of southern iron states that this year his sales probably will not reach 50,000 tons.

Present and Proposed Rates

The following table shows the present rates on pig iron, gross tons, from Birmingham, Ala., the rates which were asked by complainants in the Sloss-Sheffield case, and the action of the Interstate Commerce Commission:

	Present rate	Rate ask'd	Rate ord'd
To Cincinnati	$3.25	$1.82	$2.90
To Louisville	3.00	1.82	2.65
To Chicago	4.35	3.00	4.00
To Boston (All rail)	6.40	3.75	
To Boston (Rail and water)	.4.60	3.75	4.25

Request was made for reductions from the Chattanooga, Tenn., district in proportion to those asked from Birmingham district, Chattanooga rates being generally 25c and 35c per ton less. This was granted.

Birmingham Makers Jubilant

Birmingham, Ala., July 7. (By wire.)—New hope was injected into the Birmingham pig iron market today when announcement came from Washington of the Interstate Commerce Commission decision lowering freight rates to the middle west and eastern points. Iron makers feel that, while the reduction is not as large as they asked for, it will soon show a material effect in strengthening the Birmingham market.

"We have great reason to feel elated over the decision," said J. W. McQueen, vice president of the Sloss-Sheffield Steel & Iron Co, in whose name the suit against the railroads was filed some 20 months ago. "The decision provides for a reduction in rates varying from 35 to 75 cents per ton, 35 cents to middle western and northern points and 75 cents to some New England points, such as Portland, Me., for instance.

"We had asked for a reduction of $1 and the decision, it appears, is a sort of compromise. We didn't get what we wanted, but we are thankful for small favors. The new rates will give Birmingham iron makers an increased power of competition with northern and eastern furnaces, although it is not enough to place us on a straight out competitive basis with Pittsburgh and similar iron centers. Of course, it remains to be seen just what effect the new rates will have, but we have every hope of their proving a distinct advantage. We believe the railroads will acquiesce in the decision. They fought the case very hard, however, and from the very first practically laughed at us, stating that we could secure no reduction, and it may be they will enjoin the rates and enter into a further contest."

Other iron company officials today made statements practically agreeing with Mr. McQueen.

The railroads increased the Birmingham rates a couple of years ago. When the iron market was soaring they made one increase when Birmingham iron went past $12 and another when it passed $17. When the market declined, they refused to reduce their rates and it was then that all of the iron companies of the states of Tennessee and Alabama with the exception of the Tennessee Coal, Iron & Railroad Co., united in the suit before the commerce commission which

was filed in the name of the Sloss-Sheffield company.

As Viewed at Pittsburgh

Pittsburgh, July 8.—Pittsburgh representatives of southern pig iron making concerns do not regard the decision of the Interstate Commerce Commission in the Sloss-Sheffield pig iron rate case as particularly favorable to the movement of larger tonnages of southern iron to that center. A representative of one of the most important southern pig iron selling houses in the Pittsburgh district pointed out yesterday that fully $1 a ton should have been cut off the present freight rate of $4.90 a ton from Birmingham, whereas only about 35c has been taken off. With foundry iron from nearby furnaces getting about $13.90 to $14.40, Pittsburgh, southern iron would have to sell at $9.45, Birmingham, to even meet the northern price. Hence, Pittsburgh sales agents for southern iron cannot see much hope for them with the small rate reduction. They take the same view of the southern pig iron situation as to Chicago and Cleveland, and say it looks as if about the only thing it will do is to make more competition in New England for the Buffalo and Virginia furnaces, which sell largely into that territory.

Prompt Plates

Are Soft in Eastern Territory—Mills Are Not Gaining

The open market for prompt delivery plates in eastern Pennsylvania remains 1.25c to consumers or 1.10c, Pittsburgh, but this figure is being shaded on an attractive lot. Forward plates are held $1 higher, but some eastern mills declare they are not going beyond the third quarter at this price. Mill orders are in small lots and the tonnage varies from week to week, so that plant operations are irregular. The situation in general is not improving. The New York Shipbuilding Co. has placed the steel, about 3,500 tons, for a new vessel for Jacksonville lumber interests and several other boats are pending before eastern yards on which action is coming slowly.

More Hopeful at New York

Prospects of better car buying by railroads with headquarters in New York in the near future, are giving a more hopeful feeling to the plate trade in the New York district. Current orders for plates, however, remain rather light and are of small odd-lot character. Most of such business is going to eastern Pennsylvania makers at general price of 1.26c, New York, or 1.10c, Pittsburgh, though where the requirement is more attractive, this figure sometimes is shaded.

No Boost For Plates

Steel plates are still selling in the Chicago market on the basis of 1.28c to 1.33c, Chicago, with an occasional transaction at 1.25c, Chicago. Considerable tonnage has been placed recently to cover purchases of cars, but mills have been sufficiently hungry to absorb this without having any effect on prices.

Fairly Active

In Cast Iron Pipe in Eastern Territory

Some eastern pipe foundries still are quoting down to $19, at the plant, for 6, 10 and 12-inch pipe. New lettings in eastern territory are smaller, but the market remains fairly active. Southern shops have been taking a liberal tonnage. Henniker, N. H., has taken bids on 600 tons of 6, 8 and 10's. John Fox & Co. are low at $20.48, delivered, on 200 tons, largely 6-inch, for Belleville, N. J. The United States Gas & Electric Co., Houston, Tex., is closing for 1,200 tons of 4 to 12's. Jersey City has taken bids from contractors on 800 tons of 8 to 20's. The large requirement of the government for Panama, about 12,000 tons, was bid upon this week but the result has not yet been announced.

Cast Iron Pipe Slow

Competitive business in cast iron pipe has not quickened in the Chicago district and comparatively few municipal jobs are pending. A small tonnage at Hammond, Ind., was taken by the Lynchburg Foundry & Machine Co. and the United States Cast Iron Pipe & Foundry Co. has contracted for about 1,500 tons of small sizes which will go into the Canadian Northwest. Routine business has been excellent and this is maintaining the market.

Gloomy

Are Conditions on the Lakes—Sales Are Very Slow

No material improvement is expected during July in the lake ore situation and from the vessel-owning standpoint the month is likely to prove one of the worst in lake history. More vessels are being sent to dock and shippers can scarcely take care of their own tonnage. Sales of ore are very slow and furnacemen that have placed orders are not ready in some instances to have the ore delivered.

Out of the total movement of 5,502,367 tons during June, 4,383,045 tons were received at Lake Erie ports, distributed as follows:

Port.	June, 1914.
Buffalo	402,621
Port Colborne	37,551
Erie	53,467
Conneaut	1,143,049
Ashtabula	977,358
Fairport	207,051
Cleveland	914,285
Lorain	363,219
Huron	104,447
Sandusky	.....
Toledo	114,945
Detroit	65,052
Total	4,383,045

More Chilean Ore Arrives

The steamer Twickenham, with a cargo of 7,200 tons of Chilean iron ore, arrived at Philadelphia last week from Cruz Grande. The ore was brought in from the properties of the Bethlehem Steel Co. and represents the second cargo of this material to be received in this country. To date, about 14,000 tons of this ore have arrived. Ore sales of consequence in the eastern market still are lacking. Foreign ore especially attracts no interest. Sales are confined to occasional odd lots of local ores.

Warehouses

Enjoying Good Business at Chicago—Improvement at Cincinnati

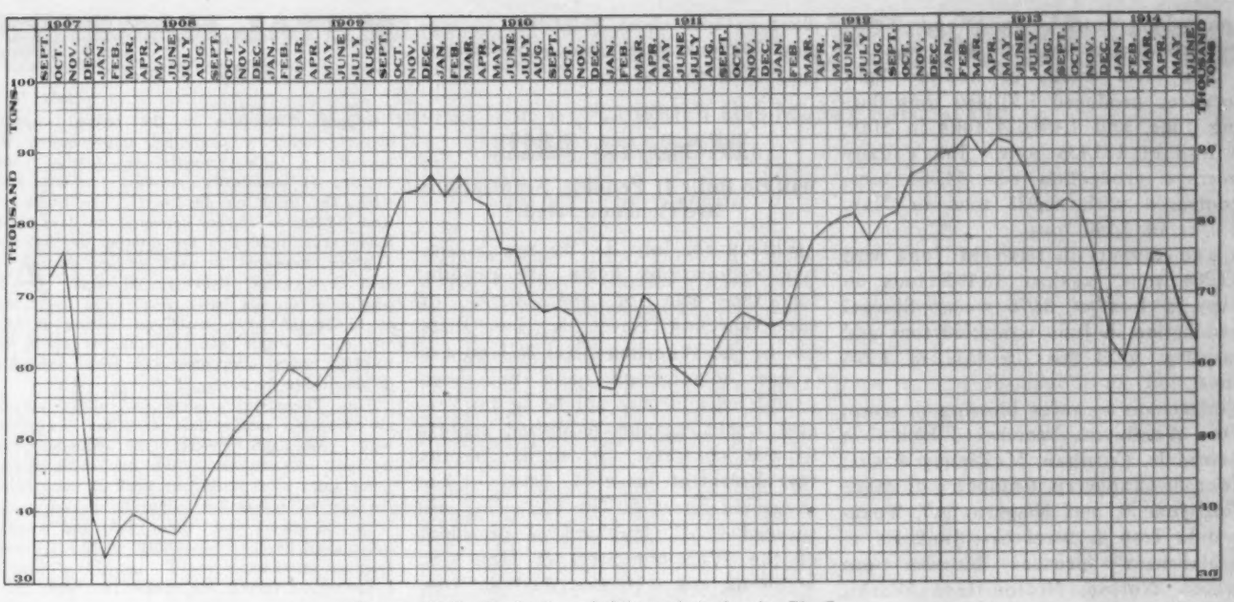
Business, especially in structural lines, continues brisk with Chicago warehouses, reaction from the quiet produced by the brick makers' strike resulting in demands for an unusual quantity of material for structural purposes. Other lines also are active and prices remain steady at present quotations.

Hoops Low in Cincinnati

At Cincinnati, warehouse business done during the first few days of July has been as good as any time in June, which latter month showed an increase over April and May. Transactions today, however, are not very heavy, but are fair considering present conditions. A few small local houses are offering steel bars at 1.70c, but the larger ones are holding at 1.80c and 1.85c. One dealer here is offering hoops at resale at 1.80c, which is considerably below the market. Iron bars are stationary at from 1.65c to 1.75c, the former price being the more general. Sheets are unchanged, galvanized No. 28 gage being given at 3.40c to 3.55c and black No. 28 gage at 2.45c to 2.55c.

Philadelphia Prices Low

Plates and shapes from warehouse at Philadelphia are selling at 1.65c and bars $1 lower. These prices have been cut in recent instances in eastern Pennsylvania territory. Business is better than it was but is not active.



Average Daily Production of Coke and Anthracite Pig Iron

Pig Iron Output Declines Sharply

Closing a half-year period of decreased production, June showed a big decline from May in the output of coke and anthracite pig iron. Blast furnace output last month was 1,904,566 tons compared with 2,097,019 tons in May, a decrease of 192,453 tons. With the exception of January and February of this year, the month's total was the smallest of any since July, 1911.

For the six months ended June 30, pig iron production was 12,372,580 tons compared with 14,335,413 tons in the last half of 1913 and 16,317,354 tons in the corresponding months of last year. First half production was at the rate of 25,000,000 tons against an output last year of almost 31,000,000 tons.

Daily average production in June was 63,486 tons, compared with 67,646 tons in May, a decrease of 4,160 tons. The average maintained in June was practically the same as in December, 1913, and with the exception of January of this year was the lowest of any month since August, 1911.

There was a net loss of five in active blast furnaces. The number in blast on June 30 was 193. There were 191 furnaces in blast on Dec. 31, 1913, and 193 on Dec. 31, 1910. With these exceptions, the number of stacks blowing was the lowest since Sept. 30, 1908. Four merchant furnaces resumed operations in June, and seven went out of blast, a net loss of three. One steel works furnace went in blast and three blew out, a net loss of two. In all, five furnaces blew in and 10 blew out.

The merchant furnaces showed the greater decline last month, in contrast with preceding months when the increase or decrease was governed largely by the activities or closing down of the steel works furnaces. Merchant iron production in June was 556,826 tons, against 620,891 tons in May, a decline of 64,065 tons. The merchant furnaces averaged 18,561

MONTHLY PRODUCTION.

	1914.	1913.	1912.
January	1,879,336	2,787,800	2,052,806
February	1,888,607	2,578,670	2,098,796
March	2,341,551	2,762,823	2,411,529
April	2,261,501	2,754,353	2,377,621
May	2,097,019	2,816,825	2,503,341
June	1,904,566	2,616,883	2,433,737
Total 1st half	12,372,580	16,317,354	13,877,830
July	.....	2,558,275	2,402,567
August	.....	2,537,018	2,500,163
September	.....	2,494,098	2,444,454
October	.....	2,539,924	2,683,645
November	.....	2,229,960	2,639,562
December	.....	1,976,138	2,777,292
Total 2d half.	.....	14,335,413	15,447,683
Grand total.	.....	30,652,767	29,325,513

AVERAGE DAILY PRODUCTION.

	1914.	1913.	1912.
January	60,624	89,929	66,220
February	67,450	92,095	72,372
March	75,534	89,123	77,791
April	75,383	91,812	79,254
May	67,646	90,865	80,753
June	63,486	87,229	81,125
July	.....	82,525	77,502
August	.....	81,839	80,650
September	.....	83,137	81,482
October	.....	81,933	86,569
November	.....	74,322	87,985
December	.....	63,746	89,590

JUNE PIG IRON.

States.	No. of stacks.	No. in blast last day of month. June.	May.	Total tonnage made. Merchant.	Non-Merchant.	Totals— June.	May.
Pennsylvania	157	74	78	142,925	606,688	749,613	828,326
Ohio	73	42	42	114,205	318,024	432,229	490,692
Alabama	45	19	18	105,347	38,820	144,167	152,055
Virginia	22	7	7	23,866	.....	23,866	27,073
New York	26	13	14	71,131	55,708	126,839	141,306
New Jersey	7	2	2	10,327	.....	10,327	10,880
Illinois	26	12	13	28,738	140,318	169,056	182,386
Colorado	6	2	2				
Indiana	10	8	8				
Maryland	4	2	2				
Wisconsin	6	3	3	20,974	165,050	186,024	190,822
Kentucky	7	1	2				
West Virginia	4	1	1				
Tennessee	18	5	4				
Washington	1	0	0	24,209	6,878	31,087	31,935
Georgia	2	0	0				
Texas	3	0	0				
Minnesota	1	1	1				
Michigan	3	1	1				
Missouri	1	0	0	15,104	.....	15,104	20,040
Spiegel—All states...						4,050	5,324
Ferro—All states....						12,204	16,180
Total	422	193	198	556,826	1,331,486	1,904,566	2,097,019

tons daily during June and 20,029 during May, a loss of 1,468 tons.

The steel works or non-merchant furnaces produced 1,331,486 tons during June, and 1,454,624 tons in May, a loss of 123,138 tons. June's daily average production was 44,383 tons, compared with 46,923 tons in May, a loss of 2,540 tons.

The output of ferro in June was 12,204 tons, against 16,180 tons in May, a loss of 3,976 tons. Spiegel production in June was 4,050 tons and in May 5,324 tons, a loss of 1,274 tons.

Merchant furnaces blowing in were: One Woodward, Woodward Iron Co.; Scottdale, Corrigan, McKinney & Co., June 8; Cranberry, Cranberry Furnace Co., June 8, and Niagara "A", Tonawanda Iron & Steel Co., June 10.

Merchant furnaces blowing out were: Norton, Norton Iron Works, June 27; one Buffalo, Buffalo Union Furnace Co.; Jisco, Jackson Iron & Steel Co., June 23; Bird Coleman No. 1, Lackawanna Iron & Steel Co., June 1; Palmerton No. 1, New Jersey Zinc Co., June 22; Earlston, Joseph E. Thropp, June 7; and Niagara "B", Tonawanda Iron & Steel Co., June 10.

The steel works furnace blowing in was one Central of the American Steel & Wire Co.

Steel works furnaces blowing out were: South Works No. 1, Illinois Steel Co., June 26; Cambria No. 3, Cambria Steel Co., June 21, for rebuilding, and Atlantic, Republic Iron & Steel Co., June 9.

Jefferson furnace, of the Jefferson Iron Co., Oak Hill, O., has been relighted. It is one of the few remaining charcoal furnaces in Ohio.

Jisco stack, of the Jackson Iron & Steel Co., Jackson, O., was blown out June 23. This stack will be out of blast for some time while a skip hoist, steel trestles and bins are installed.

The Andover blast furnace at Andover, N. J., has been sold to Henry A. Hitner Sons Co., of Philadelphia, who will dismantle the plant. The Andover furnace property was purchased some months ago from the Joseph Wharton estate by the Pennsylvania railroad for yard extensions. The furnace which was operated by the Andover Iron Co. has not been active for several years.

Will Build Big Plant

The Otto Coking Co., New York, has been awarded the contract for the construction of the plant of the Niagara Coke Corporation on a 40-acre tract recently purchased from the Stony Point Land Co., on the Hamburg turnpike, near Buffalo. The company plans a plant to cost about $1,000,000, to employ 700 men and capable of carbonizing 1,700 tons a day.

Modern Mill

Will Be Built If Pending Negotiations Are Consummated

Pittsburgh, July 8. (By wire.)—Active negotiations again are pending for the sale of the works of the Wheeling Sheet & Tin Plate Co. to the Wheeling Steel & Iron Co. These negotiations have not been completed and may not be be for several weeks despite published reports to the contrary. A similar report that President Isaac M. Scott, of the Wheeling Sheet & Tin Plate Co., will succeed C. R. Hubbard as president of the Wheeling Steel & Iron Co., is premature. If the deal is consummated, the Wheeling Sheet & Iron Co. will build a modern sheet bar mill.

Bookings

Heavier Than Shipments of the Steel Corporation

New York, July 8. (By wire.)—Indications are that the Corporation's June unfilled tonnage to be announced Friday will show a small increase. Bookings last month were about 3,000 tons daily over shipments, but some cancellations figured, which will reduce the net result. New business with the leading interest holds up to the June rate. It may be necessary to blow in two additional stacks in the Pittsburgh district, as iron stocks are much reduced.

Leading steel companies generally report increased inquiry for contracts and better bookings, but they are not disposed to sell for protracted deliveries at current prices.

Steel Pipe Specified

The city council of Lewistown, Mont., recently awarded a contract for its water pipe requirement to the National Tube Co., Pittsburgh, steel pipe being specified as against cast iron pipe, which formerly was used. The city engineer for Lewistown, after making a careful investigation of Matheson joint pipe with National coating, unreservedly recommended this pipe, which is manufactured by the National Tube Co.

The L. S. Starrett Co., Athol, Mass., which a few weeks ago clipped the working schedule down to five days a week, has further reduced the working time to four days.

METAL MARKETS

New York

July 7.

Copper.—The tone in the refined copper market, under a continued improvement in buying, by both domestic and foreign consumers, is manifestly stronger. Since last week, the price on electrolytic has advanced from 13.50c to 13.75c, delivered 30 days, and today some producers are quoting as high as 13.87½c, delivered 30 days. Prime casting is held at 13.62½c, delivered 30 days. On a wholesale contract basis, electrolytic is quoted at 13.60c to 13.65c, cash and casting at 13.50c, cash. Prime lake is quoted at 13.75c to 13.87½c, cash, with plenty of metal available at the inside figure.

Tin.—There was a good deal of buying on an advancing market last week but beginning with yesterday's decline the demand has dropped off and today the market is quiet. Some sales were made last week at more than the cost to import but today the market again is at the import cost. Spot, July and August are quoted at 32c; September at 32.12½c and October at 32.25c.

Spelter.—Demand for spelter is very quiet and the market continues to lack a firm tone. Prime western brands are available in New York at 4.95c to 4.97½c, which is on the basis of 4.80c to 4.82½c, St. Louis.

Lead.—The leading interest continues to ask 3.90c, New York, and this price continues to be met by independent producers. In St. Louis the market is weak and sales are heard of at 3.75c to 3.77½c. Demand is quiet.

Antimony.—Prices are lower due to selling pressure. Demand is dull. Quotations on large lots, duty paid, New York, are as follows: Cookson's 7c to 7.12½c; Hallett's and United States, 6.75c to 6.85c; other brands 5.50c to 5.62½c.

Aluminum.—Demand is very quiet. The price has weakened and spot and future foreign are quoted at 17.37½c to 17.62½c, duty paid, New York. Domestic is quoted at 17.25c to 17.75c, New York.

Chicago

July 7.

There has been no increase in trading in new metals and prices are only slightly changed, spelter being a shade lower and pig tin a trifle higher than last week.

We quote dealers' selling prices f. o. b., Chicago, as follows:

Lake copper, carload lots, 13.75c; casting, 13.75c; smaller lots, ¼c to ¾c higher. Spelter, car lots, 4.90c; lead, desilverized, 3.80c; sheet zinc, $7.00, f. o. b. La Salle, in car lots of 600-pound casks; pig tin, 32.00c; Cookson's antimony, 7.25c; other grades, 5.75c.

In old metals the apathy of buyers and sellers continues unabated and material in this classification is not moving. Quotations are unchanged from last week and are largely nominal.

We quote dealers' selling prices f. o. b., Chicago, as follows:

Copper wire, crucible shapes, 12.50c; copper bottoms, 11.00c; heavy red brass, 11.00c; heavy yellow brass, 8.75c; No. 1 red brass borings, 10.00c; No. 1 yellow brass borings, 7.50c; brass clippings, 8.50c; lead pipe, 3.60c; zinc scrap, 3.90c; tea lead, 3.30c; No. 1 aluminum, 11.50c; No. 1 pewter, 19.00c; block tin pipe, 28.00c; tin foil, 23.00c; linotype dross, 2.75c; electrotype dross, 2.75c; stereotype plates, 4.00c; stereotype dross, 2.75c.

Albert Pott, sales manager of the Baird Machine Co., Bridgeport, Conn., sails July 15 for a two months' business trip to Great Britain and France.

Historic Furnace in Berkshires

Plant of Richmond Iron Works Which Has Made Charcoal Pig Since 1827

BY E C KREUTZBERG

ALTHOUGH New England in the early Colonial days was one of the leading producers of pig iron in this country, her share of this industry now is concentrated in five charcoal blast furnaces which continue to operate in the western section of Massachusetts and Connecticut. Of these furnaces, one is located at Cheshire, Mass., one at Richmond Furnace, Mass., one at Lime Rock, Conn., and two at East Canaan, Conn. They continue to produce from the brown hematite ore of the Berkshire hill deposits certain famous brands of pig iron which have been used for generations by foundrymen throughout the country. The surviving portion of the industry is in prosperous condition, and bids fair to flourish indefinitely, since the demand for the product shows no signs of decreasing.

The iron turned out in the Berkshire country is of a close-grained texture and possesses great tensile and transverse strength, making it peculiarly suitable for use as a strengthener in foundry mixtures. It owes these properties to the ore from which it is produced; just what metallurgical causes, however, bring about the results obtained, have never been exactly determined. The blast furnace men say the ore contains certain beneficial elements, such as nickel and titanium and that their occurrence in natural combination leads to the production of a better grade of iron than could be obtained were the same elements to be included in a made-up blast furnace mixture. Be this as it may, the iron, produced through all these years by the same old fashioned charcoal methods continues of unvarying quality.

Made Since 1827

Richmond iron, one of the celebrated brands produced in the Berkshires, has an unbroken history running back to 1827. In that year, ore first was taken from an outcrop at what now is known as Richmond Furnace, in Richmond township, Berkshire county, Mass. At first it was carried in saddle bags to a forge at Glendale, Mass., where Richmond iron originally was produced in small quantities. Shortly afterward, in 1829, a furnace was erected close to the ore workings and ever since that date iron has been produced continuously on this site.

Richmond iron is particularly suitable for taking a chill and always has been used widely for this purpose. One of the leading trunk line railroads has been using it constantly since 1870 for making chilled car wheel mixtures and during all these years that road never has experienced a wreck due to failure of a wheel in which this iron was a part of the wheel mixture. During the civil war the output of the furnace was devoted almost exclusively to the manufacture of the then well-known "Rodman" guns. All the iron which went into the construction of the guns for the Monitor also came from this stack. Richmond iron is employed extensively for mixtures used in casting superheaters, high pressure castings, ammonia castings, chilled rolls, steam cylinders and other castings requiring strength and close-grained structure.

In Fig. 1 is shown a view of Richmond furnace as it appeared during Cleveland's administration. This photograph was taken to show the effect of the hard times of 1893 in causing

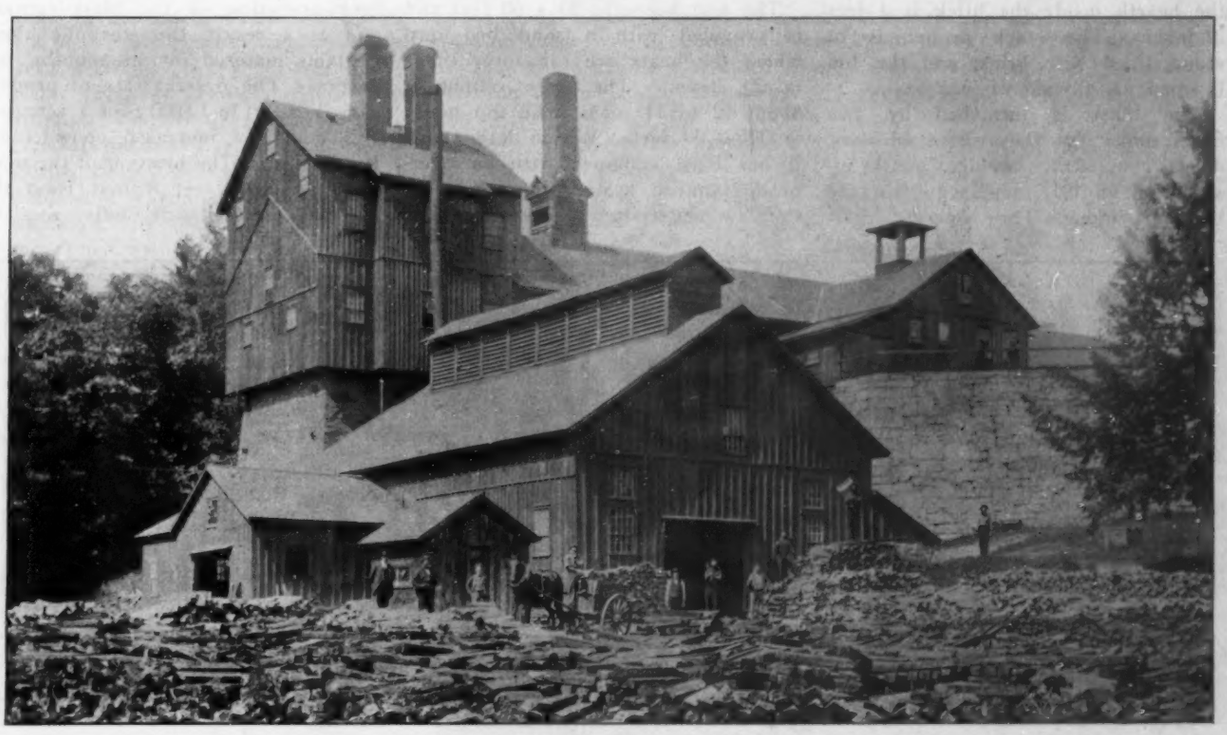


FIG. 1—RICHMOND FURNACE IN 1893, SHOWING HOW PIG IRON STOCKS PILED UP DURING THE HARD TIMES

pig iron stocks to pile up. With the exception that only the normal amount of pig iron now is carried in the yard, the exterior view of the furnace remains the same at present as it was in 1893.

Originally a Stone Stack

Originally the furnace had a stone hearth, stone stack and open top, being provided with the dam and tymp form of construction which was usual in those days. The blast was furnished by a blower actuated by a water wheel of the old-fashioned overshot type. This stack was operated until 1863. In that year it was partially rebuilt and at the same time the water wheel was abandoned and a blowing engine installed. In 1905, the furnace was completely overhauled. The stone hearth was torn out and replaced by a brick-lined, cast-iron, water-cooled hearth, and new tuyeres were provided. They are of the bronze, water-cooled variety and are five in number, being located at a height of 27½ inches above the bottom of the hearth. About 30 years ago a warm blast stove was provided. It is bricked in at the front of the stack. The incoming air passes through 28 U-shaped cast iron pipes, being heated to a temperature of approximately 500 degrees Fahr. by the flame coming from the top of the furnace. The furnace operates on a blast pressure of ¾ pound. The furnace is 35 feet high and has a bosh diameter of 9 feet; the diameter of the hearth inside the brick is 4 feet 2 inches. The stack proper is of stone, lined with brick, and the top is open as it was originally.

The blast is furnished by two Sturtevant, No. 9 positive blowers, direct coupled to engines, which installation, in 1912, superseded the old blowing engine. They operate alternately for periods of 24 hours. The power plant consists of two Babcock & Wilcox, 75-horsepower, water tube boilers, which also are operated alternately, changing from one to the other about every three months. The boilers are operated on blast furnace gas as fuel. The engine room at the furnace also contains a 5-kilowatt electric lighting plant, as well as a drill press for sampling each cast.

FIG. 2—VIEW OF CHARGING OPENING, SHOWING TRAM-RAIL AND ROD WHICH INDICATES HEIGHT OF CONTENTS OF FURNACE

The cast house is 30 x 60 feet and is provided with a sand bed into which the heats are run three times in 24 hours. The daily output is about 12 to 14 tons. The top house is 30 x 90 feet. Within late years, it has been equipped with an overhead tram-rail system for conveying the raw materials and dumping them into the furnace. The top house is large enough to hold a sufficient supply of ore, charcoal and limestone to run the furnace several days. The limestone is delivered to the top of the house in broken form and is fed through a jaw crusher, being then piled by means of a bucket conveyor.

Large Ore Supply

The ore at Richmond furnace occurs in rock formation, in veins which pitch at an angle of about 45 degrees, and which are found between a hanging wall and a foot-wall of clay. Thus it is necessary to win the ore by the liberal use of dynamite, after which it must be put through a crushing and washing process to free it from the clay. The ore averages about 45 to 50 per cent in metallic content. Until about 10 years ago, the ore was obtained from that portion of the property which since 1827 had been operated as an open-pit. Owing to the prohibitive cost of stripping, however, a shaft was sunk in 1905. It lies at an angle of 45 degrees and runs to a depth of 150 feet; at present there are about 2 miles of railroad in the underground workings, which comprise several levels. The formation in these workings indicates that the company has practically an inexhaustible supply, since the veins, as they increase in depth, also increase in thickness.

The policy of the company in mining the ore is to extract about 10 per cent more than is necessary for current operation of the blast furnace and as a result, the stockpile alone contains material for six months' operation. The present rate of production is 10,000 to 12,000 tons a year and this could be increased considerably if necessary. The location of the mine is about 1,500 feet distant from the furnace, necessitating only a short

FIG. 3—RICHMOND IRON MINE, SHAFT HOUSE, INCLINE, WASHER AND STOCK PILE

FIG. 4—INTERIOR OF WASHING PLANT

FIG. 5—BATTERY OF BLAST FURNACE BLOWING ENGINES AT RICHMOND FURNACE

haul. The mine is wet and requires the handling of a large amount of water, part of which, however, is used in the boiler and washing plants. For draining the mine, there are two electrically operated pumps and one steam pump. The power house at the mine contains two horizontal tubular boilers, one hoisting engine and one 80-horsepower engine, belted to a three-phase, 220-volt alternator, which supplies power for the washing and crushing plants and for operating the mine. The washer used is of the Bradford type.

The property also comprises three limestone quarries, seven charcoal kilns, a building having capacity for storing 200,000 bushels of charcoal, a stable and wagon shed, and an office building. The plant is served by a connection with the Boston & Albany railroad.

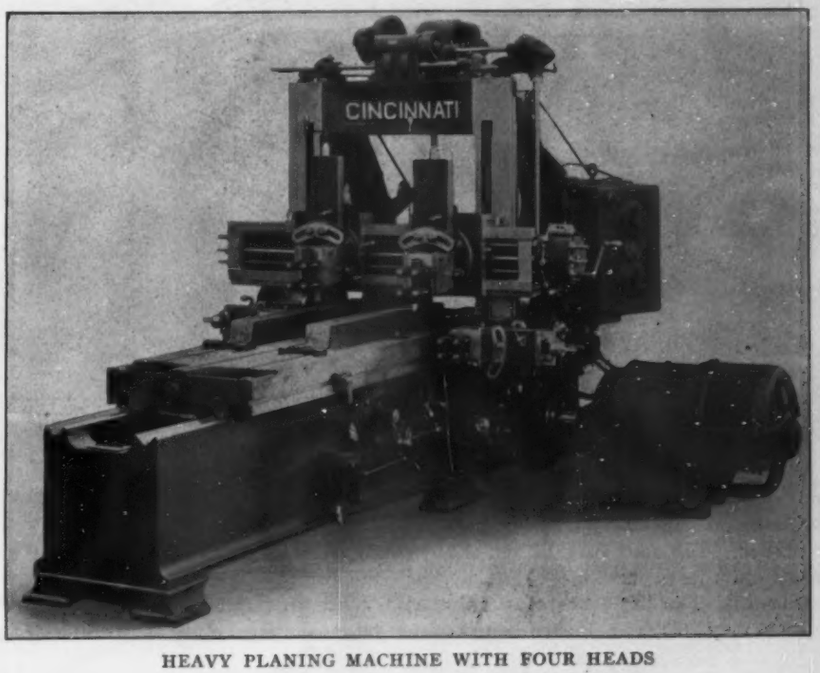
The Richmond Iron Works was incorporated in 1905. Prior to that date the concern always had been known as the Richmond Iron Co. The officers of the company now are: President, Samuel G. Colt; vice president and treasurer, William H. Hall and secretary, Ray C. Williams. Mr. Williams also is superintendent of the blast furnace. The company also owns the furnace at Cheshire, Mass., which at present is idle. This is 32 feet high and 8 feet in the bosh. It was built originally in 1850, rebuilt in 1870 and thoroughly overhauled in 1906-7. Its construction is similar to that of the Richmond furnace.

The Cataract Refining & Mfg. Co., Buffalo, manufacturer of core oils and core compounds, has taken over the business of the Peterson-National Core Oil Co., and hereafter will manufacture the different grades of liquid core compounds heretofore made by the Peterson-National company. The Cataract Refining & Mfg. Co. operates two plants at Chicago and Buffalo respectively, and is in position to make prompt shipments of any size order from a barrel to a tank car. The manufacture of the parting compound heretofore made by the Peterson-National company also will be continued and its trade name has been changed from Peterson parting to Bison parting.

Four Head Planing Machine

At the exhibit of machine tools recently held at Atlantic City in connection with the convention of the Master Car Builders' and Master Mechanics' Associations, the Cincinnati Planer Co., Cincinnati, displayed a heavy pattern planing machine. It is equipped with four heads and a reversible motor drive, which provides ten cutting speeds, ranging from 25 to 60 feet per minute, and the same number of return speeds, the maximum one being 100 feet per minute. The machine will handle work up to 36 inches square and 8 feet long. One of the features of the machine is the rapid power traverse that is provided for the heads.

The motor at the top of the housing delivers power through spur gears to the rail elevating device and then to the horizontal rapid traverse shaft. This shaft has a bevel gear meshing with one on the vertical rapid traverse shaft at the side of the housing, which in turn transmits its power to a pair of spur gears at the end of the rail. The regular feed is transmitted to the heads from the friction on the end of the pinion shaft to the trigger or feed gears at the end of the rail by a gear segment and rack in the usual way. The feed and rapid power traverse gears on the rail screws, and the rod are free to revolve until clutched by a spool which has a neutral position in which neither one is engaged. In this way, it is pointed out, both the rapid power traverse and the feed cannot be engaged at the same time. Provision has been made for the pro-



HEAVY PLANING MACHINE WITH FOUR HEADS

tection of the mechanism against accidents. The clutch spools are controlled by three handles at the end of the rail, while another just under them engages the rapid power traverse, the movement of the head being in the same direction as that in which this handle is moved. This four-head planing machine is equipped with steel gears and racks throughout and is said to be capable of taking heavy cuts at high speeds. The housings extend to the bottom of the bed, where they are securely bolted, doweled and locked in position by two large keys. Taper gibs are employed throughout for the rail and side heads and the former have micrometer readings in any direction. All of the gears are covered with guards to prevent accidents to the operator.

The Slick Steel Tie for Mines

THE MINE TIE illustrated herewith is the outcome of studies and experiments made by E. E. Slick, vice president and general manager of the Cambria Steel Co., Johnstown, Pa. These ties may be made for any desired gage of track; the most popular sizes for mine work are from 3 feet to 3 feet 9 inches. A tie of this kind complete with fastenings weighs 10 pounds, as compared with 14 to 16 pounds which is the average weight of a 3 x 4-inch wood tie. These figures cover ties designed for a 3-foot gage track. The rail is fastened to the steel tie by means of steel buttons which are always in place, ready for use and cannot become detached and lost. The small spikes which are used for securing rails to wood ties are seldom used more than once as they become broken, bent or thrown away through the carelessness of track layers.

The Slick steel tie is made in two different styles, one being intended for insertion under the continuous portion of the track, while the other form is used at the ends of rails. In ordinary cases the joint ties are provided with four clips at each end, two for each end of each rail so that no fish-plates or other rail splices are needed. The rails may be set end for end on the tie and made fast by the buttons. The buttons are so adjusted that they may be turned with comparative ease by the means of an ordinary long handled wrench and they are put on in such a manner that the friction of the rivet which holds them is sufficient to secure them in any position to which they may be turned.

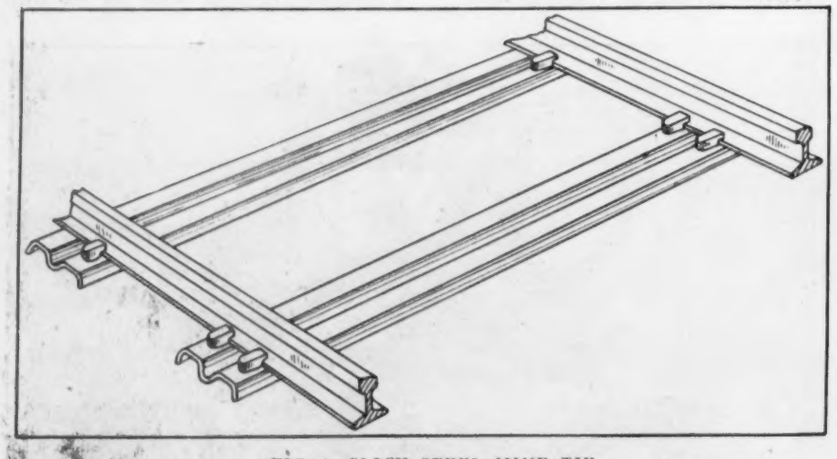


FIG. 1—SLICK STEEL MINE TIE

Washers Under the Rivet Heads

In certain cases washers are inserted under the rivet heads. They may be either flat or slightly concave; the latter form produces a certain kind of spring action which gives turning friction to the fastening, while at the same time allowing the button to be turned without twisting off the shank of the rivet. Although the tie is very light, it is said to have sufficient strength and stiffness for any legitimate purpose. This tie is adapted for use on industrial railways, in mines of all kinds, in factories, construction work and similar locations.

The ties are made with a minimum height of ½-inch which is of considerable advantage in small mine haulage ways. On account of their thinness, the ties may be laid directly on the floor of the mine and placed about 8 feet apart. In this case, the lower flange of the rail rests on the bottom of the mine between the ties, thus providing the maximum clearance between the top of the car and the roof.

Although the steel tie is admittedly more durable than the wooden one, its actual life depends upon service conditions. In certain mines in Cambria county and elsewhere in Pennsylvania, where the rooms are dry, it is reasonable to believe that these steel ties will last for ten years. In wet locations, however, where the water is sulphurous the ties will not last as long. Steel ties weigh less per tie than the wooden ones, as pointed out above, and also take up about one-sixth as much space. They are, therefore, more easily handled in the mine and require only a fraction of the storage space which is needed for wood ties.

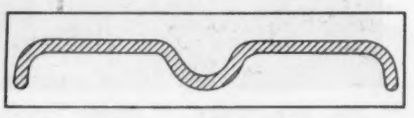


FIG. 2—CROSS SECTION OF SLICK TIE

The Cambria Steel Co. has compiled figures which indicate that the replacement cost of wood ties under 300 feet of 3-foot gage mine track in five years is $63.81. Steel ties used under the same conditions will cost $31.45; the advantage in favor of steel is, therefore, $32.36. These ties are manufactured exclusively by the Cambria Steel Co., Johnstown, Pa.

The E. J. Woodison Co., Detroit, manufacturer and dealer in foundry supplies and equipment, recently completed the installation of a buffing composition plant for manufacturing composition for finishing nickel plate on brass, nickel plate on iron and other material, such as tripoli, crocus, emery cake, coloring composition, etc. The Woodison company also is placing on the market a metal rim riddle with an adjustable bottom. These riddles are being made in two sizes, namely, 18 and 20 inches in diameter, provided with both galvanized and brass bottoms or sieves.

The Welding Materials Co., New York City, has removed from 149 Broadway to the Engineering building, 114 Liberty street, New York City.

How to Make Good Car Wheels

Some Features of the Metallurgical Problems Involved, Specially Referring to the Strength of Flanges

BY E B TILT

THE PROBLEM that I wish to consider is to make a sound car wheel which will be safe and will give good wearing qualities. All questions of design, including flange and plate thickness, which also include weight, have been disregarded, and the question is a purely metallurgical one—how to make white iron harder or more resistant to wear, and how to make the combination of white and gray iron in the flange stronger or tougher as well.

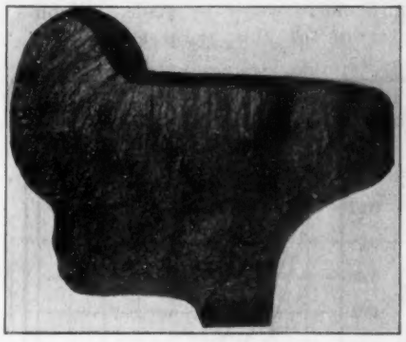


FIG. 1—A NEW 675-POUND, MASTER CAR BUILDER, 1909 DESIGN WHEEL

Fig. 1 shows a new 675-pound Master Car Builders' 1909 design wheel, in accordance with the specification with reference to chill. It may be stated that the Master Car Builders' specifications prescribe a method of selecting representative wheels for test, which are drop-tested for strength and thermal-tested to show their capacity to resist the heating action of the brakes. All wheels are inspected for molding defects.

Fig. 2 shows a flange which has been knocked off with a hammer to show the direction of break. This is one of the greatest sources of danger in the cast-iron wheel, though a seam at the throat very often precedes failure. Fig. 5 shows a typical failure due to over-heating by the brakes. Figs. 3 and 4 show "brake burns" and "shell outs," respectively. These are minor defects, but to increase the service of the wheels they should generally be a minimum. It is not known whether metal which shells out or brake-burns easily is dirty or has more impurities than a metal which does not.

There is at present some disagreement among authorities on chilled cast iron as to the best mixtures. Some contend that charcoal iron of chilling quality is necessary (No. 1); others that steel scrap and ferro-manganese (No. 2) serve the same purpose. A representative mixture of each is approximately as follows:

MIXTURE NO. 1.

	Per cent.
Charcoal pig iron	70
Scrap wheels	30

MIXTURE NO. 2.

	Per cent.
Coke pig iron	45
Old wheels	45
Malleable scrap	5
Steel	5

Wheels made by each mixture meet the specifications, and the advocates of each seem satisfied with the service results obtained. In the author's opinion the latter depends on the final composition, and care of manufacture and inspection. Direct comparisons are difficult to make on account of different methods of keeping records; and comparison of wheels made now

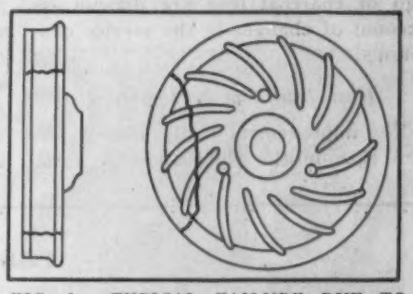


FIG. 5 — TYPICAL FAILURE DUE TO OVERHEATING BY BRAKES

FIG. 2—FLANGE KNOCKED OFF WITH HAMMER, SHOWING DIRECTION OF BREAK

FIG. 3—"BRAKE BURNED" TREAD

FIG. 4—"SHELL OUTS" ON TREAD

Presented at the Atlantic City meeting of the American Society for Testing Materials, June 30-July 3.

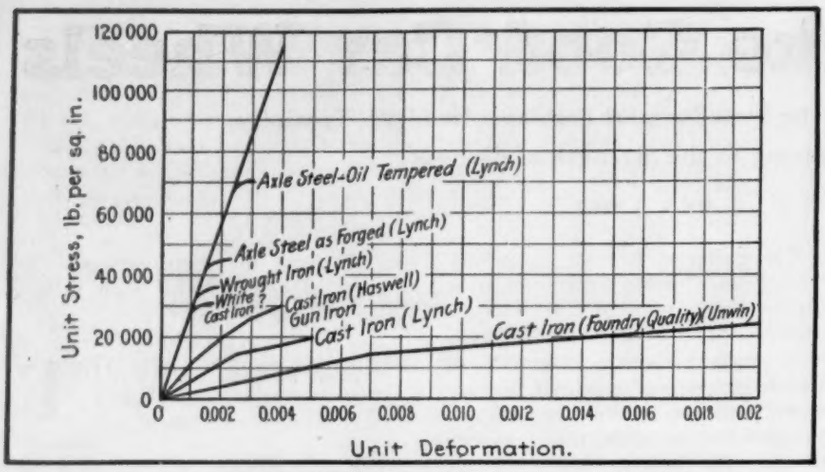


FIG. 6—STRESS-DEFORMATION CURVE FOR THE COMMON STEELS AND CAST IRON

of coke iron with wheels made years ago of charcoal iron are difficult on account of changes in the service conditions.

How Iron Can be Improved

The improvement of the chilled iron lies then in the elimination or variation of certain of the constituents and their compounds, which compose the wheel; or in the addition of other elements or compounds. A representative analysis of the present-day wheel iron, using coke pig iron and steel, is as follows:

	Per cent.
Total carbon	3.60
Silicon	0.60
Manganese	0.50
Phosphorus	0.30
Sulphur	0.12
Iron	remainder

It is supposed that the metalloids and their compounds, and the compounds of silicon and manganese, compose about 30 per cent of the total volume. Any one of the above can be varied by methods commonly known in foundries, and the best proportions are not definitely settled. Nickel, chromium, vanadium, titanium, and other metals have been used with results not always exactly determined.

It is the author's opinion, to be confirmed by further experiment, that the amount of total carbon should be low, say about 3.40 to 3.60 per cent, rather than about 4 per cent, as with many white irons. The silicon content will generally be somewhat higher than the manganese, both regulated by the practice of any particular foundry, but in the neighborhood of 0.60 per cent. Good wheels are made with sulphur as high as 0.17 per cent and phosphorus, 0.50 per cent. An examination of Fig. 1 will show the flange to be white iron in part, and Fig. 2 shows the broken flange continued down through the gray iron, which is the usual direction of breaking. Fig. 6 shows stress-deformation curves for gray irons from the sources noted, and for comparison the curve for the common steels is included. A curve for white iron is shown where it is thought it might be found, and from a consideration of this it is evident that the flange strength is dependent upon two substances. The first is the white iron which carries almost all the load until rupture takes place in it, when the gray-iron back takes the load. We have thus successive failure of the white and the gray iron, and it is evident that if both could be of the same elastic ratio an improvement would be made. A consideration of this suggests no possibility of attaining such a desideratum, so that a possible solution is to have as much white iron (a portion being necessary for wear) as can possibly be allowed, and thus also to have the gray iron as hard as possible without its being too brittle in the plates.

Table I

HEIGHT OF DROP TO BREAK BARS OF WIDELY DIFFERENT MIXTURES

Quality of Iron.	Silicon, per cent.	Combined Carbon, per cent (estimated).	How Cast.	Chill.	Height of Drop to Break, in.
Wheel iron	0.68	3.50	Chiller	Completely	15
Wheel iron	0.68	1.00	Green sand	None	27
Cylinder	1.27	....	Chiller	Around edge	14
Cylinder	1.27	0.90	Green sand	None	21
Machinery	1.60	....	Chiller	Mottled throughout	10
Machinery	1.60	0.60	Green sand	None	18

FIG. 7—(a) ENDS OF TWO CHILLED ROLLS; (b) END OF REGULAR WHEEL WITH FOUNDRY CHILL; (c) END OF PARTLY CHILLED RECTANGULAR BAR

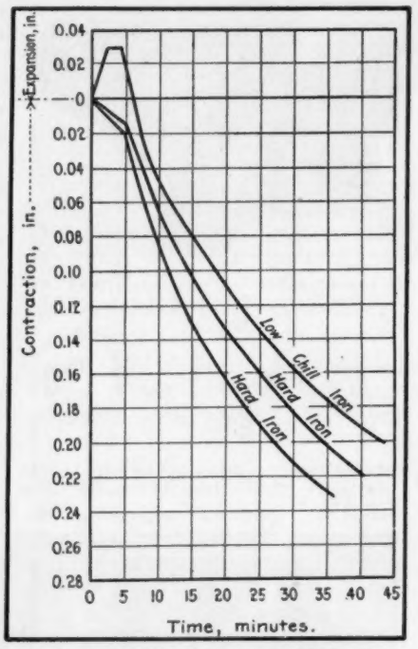


FIG. 8—SHRINKAGE CURVE FOR BAR 1 INCH SQUARE AND 12 INCHES LONG, WHEEL IRON, CAST IN SAND

In order to see whether the strength of white iron varied appreciably in our regular practice, it was decided to test chilled circular rolls, 2 inches in diameter (barber rolls), and partly chilled rectangular bars 1½ x 2½ inches. The combination chilled and gray-iron bars are similar in structure to the flange of a wheel. These were

drop-tested on 10-inch supports with a tup of 42.3 pounds, caught on the rebound. Fig. 7 shows the ends of two rolls, also a regular wheel, foundry chill block taken to show the amount of chill at each tap, and of one of the partially chilled test bars. Note the difference in the coarseness of the chill on the roll on the left, which was weak. On account of the elastic limit and tensile strength of chilled iron being practically the same, the drop is started at 8 inches and increased 1 inch at a time until the bar fails. The difference in height of the drop to break bars of widely different mixtures, in chills and in green sand, is given in Table I.

Unannealed Flanges Strongest?

The wheel iron is the strongest, whether cast in chiller or in green sand. An interesting point is that when the wheel-iron bars are annealed in the pits with the wheels (a period of 4 days), the average height of drop decreases from 15 to 12 inches. This would suggest that unannealed flanges are the strongest. When the

Table II.

DROP TESTS ON HALF-CHILLED BARS

	Depth of Chill, in.	Height of Drop to Break, in.
Maximum	1.30	18
	0.95	18
Minimum	1.05	12
	0.60	12
Average	1.20	13.5
	0.75	14

unannealed bars are heated to 500 degrees Fahr. and tested at that temperature, the average height of drop is increased from 15 to 20 inches. This suggests less liability to strip flanges by blows under heavy brake service, when the wheels would be hot.

Records were kept for a number of months operation of the wheel foundry, by plotting the results of drop tests of chilled rolls, of 1¼-inch square transverse test bars, of the chill on chill blocks, and of the hardness of the chilled rolls. A consideration of these results seems to show that the greatest strength of the white iron is accompanied by the greatest hardness, though the variation due to composition, or any other cause than flaws in the test specimens, is small.

Representative drop tests on the half-chilled 1½ x 2½-inch bars with the white iron down or in tension, are shown in Table II.

The difference in the amount of chilled iron has very small effect on the strength. This is in agreement with the foregoing, as the difference in amount is at or near the neutral axis and the strength of the metal at the surface varies very little.

In order to get a direct measure of the strength of the flange we have been drop-testing the flange of the wheels on a small drop-testing machine, with a 25-pound tup falling on a striking block 2 inches wide with a face having the contour of the throat of the flange. The wheel to be flange-tested is bored to a tight fit on a mandrel which forms a part of the foundation of the testing machine. After some experimenting 6 feet was taken as the height from which to drop the weight, and by taking one given weight and design of wheel, we have found that for the same mixture the number of blows to break off the flange is inversely as the chill. This means that a soft wheel has the strongest flange. In service we have more stripped flanges in soft wheels than in hard, but this is due to the development of cracks in the throat of the flange. This suggests that the design of the wheel and care in securing enough chill are more important than differences in quality or source of the iron.

A possible improvement in wheel iron, to avoid trouble with broken wheels, is the making of an iron with a low coefficient of expansion under brake action. Heavy braking results in heating of the tread, with consequent expansion and pulling apart of the plates; it is the ability to withstand this service that is shown by the thermal test. Thermal tests on a large number of wheels show an increase in diameter of about 1-16 inch after the iron ring has been on two minutes, failure taking place after an increase of anything from 3-64 inch up, depending upon how much white iron or combined carbon is in the plates of the wheel. The harder the wheel the more readily it is broken in the thermal test. Part cooling curves for wheel iron are shown in Fig. 8, and it would seem that shrinkage is fairly uniform for most irons of similar composition after solidification has taken place. Note the expansion in cooling of one wheel mixture which was soft. A wheel poured from this would have the flange and tread chilled and set at once and the expansion due to the gray iron behind might cause some checking of the chilled iron, which would show as a defect developed later in service. So too it has been thought by some that brake heating produces circumferential throat seams, due to expansion of the tread which is resisted by the flange. If low-expansion iron is a possibility this tendency would be lessened.

Whether unclean metal or metal high in sulphur or manganese is the most likely to shell out the author

(*Continued on page 98b.*)

Large Hoisting Block

One of the largest hoisting blocks ever constructed, recently was delivered to the Illinois Central railroad by the W. W. Patterson Co., Pittsburgh. The total weight of the block is 2,500 pounds and it is designed for a working load of 50 tons with a factor of safety of 3½. It has a ball-bearing hook forged from an 8 x 8-inch special forging billet. The finished hook is 10⅝ inches deep and 6½ inches wide at the back. The hook and the beam which supports it weigh 1,040 pounds.

The straps are made of ⅝, ½ and

LARGE HOISTING BLOCK

¾-inch plate, the latter being placed between the first and second sheaves. The tail bolt is 2 inches in diameter and the sheave pin 3 inches in diameter. The dog which prevents the sheave pin from turning is ½ inch in diameter and the head bolt is 3 inches in diameter. Each set of plates is held in position by four heavy cast iron separators.

The sheaves are 20 inches in diameter, ground smooth in the groove for a ⅞-inch wire cable. The edges of all the plates are ground and filed smooth in order to eliminate any possibility of cutting the cable. This block will be used on a 50-ton derrick car manufactured by the American Equipment Co.

How Vanadium Affects Pig Iron

A Series of Tests on Five Samples of Commercial Pig Iron Containing Vanadium

BY EDWIN O FITCH JR

THE FOLLOWING tests which were made under the writer's supervision at Lafayette College were for the purpose of determining the characteristics of five commercial grades of foundry pig iron manufactured by The Thomas Iron Co., Easton, Pa. Three of the samples were from the furnaces of the company at Hokendauqua, Pa., and the other two specimens were from the Alburtis furnaces.

The tests dealt with the pure pig, without any addition of scrap, and are of interest in that they set forth the qualities of the iron itself. Later it is proposed to continue the tests, adding scrap in different proportions, and with different qualities of coke for the purpose of determining the best and most economical practice with these grades of pig iron.

A 35-inch Colliau type cupola installed in the foundry of the department of mechanical engineering at Lafayette College was used. Jamison 72-hour coke was employed in all the tests. No flux was used except in one heat, and then 15 pounds of oyster shells were charged with 598 pounds of pig and 300 pounds of coke.

The molds for casting the test bars were very carefully made, and the bars were gated in pairs, with risers. Core sand strainers were inserted at the base of the pouring basins to preclude any possibility of slag or dirt entering the mold after careful skimming. After pouring, the bars were allowed to remain in the sand until cool. The patterns were marked to indicate the first, middle, and last parts of the heat.

Large Coke Bed Necessary

In all five tests, approximately 600 pounds of pig were used per heat, and it was necessary to use a coke bed of from 300 to 350 pounds to bring the metal to the proper height in the cupola. This gives a larger fuel ratio than would obtain in commercial practice. The shrinkage was taken over the average of each heat and was determined with the greatest possible precision.

The tensile and transverse specimens used in determining the strength of the metal were of the standard form, the tensile specimens being 0.8 inches in diameter and the transverse specimens 1 x 2 inches square, 24 inches between supports. These specimens were selected from three parts of the heat and were tested in the general testing laboratory of Lafayette College. The average strength of three specimens from each heat was determined.

The modulus of rupture given in the summary of tests which follows is the computed extreme fiber stress at the time of rupture. It is not the true fiber stress, as the formula employed does not apply beyond the elastic limit of the material.

Let S equal modulus of rupture in pounds per square inch
M equal maximum bending moment
I equal moment of inertia of cross-sectional area about neutral axis
c equal distance from neutral axis to extreme fibre

then according to the well known principles of mechanics,

$$S = M\frac{c}{I}$$

Let P equal ultimate load
l equal span (24-inch)
b equal width of specimen.
d equal depth of specimen

then $M = \frac{1}{4}Pl.$

$$c = \frac{d}{2}$$

$$I = \frac{1}{12}bd^3$$

and $$S = \frac{1}{4}P.24.\frac{\frac{d}{2}}{\frac{1}{12}.bd^3}, = \frac{36\,P}{db^2}$$

Photomicrographs and photographs of fractures were made in the metallurgical department of the college. Chemical analyses of material were made by chemists of The Thomas Iron Co., and by Dr. Porter W. Shimer, Easton, Pa.

Summaries showing the important facts gathered from the series of five tests are given below. I have included all the data obtained during the strength tests in order that it may bring out emphatically the uniformity of the strengths of the specimens selected for the tests. As mentioned above these specimens were selected from the first part, the middle, and the last part of each heat.

Test of No. 2 Plain, Cast No. 600 from Alburtis Furnace, Mark 600-A

The iron was made from a mixture containing 49 per cent Richard ore, from the mines of The Thomas Iron Co., at Wharton, N. J., and 51 per cent local ores. The cupola charge consisted of 598 pounds of pig, 300 pounds of coke and 15 pounds of oyster shells. The analyses of the pig and the castings are as follows:

	In pig.	In castings.
Silicon	1.90	1.692
Sulphur	0.04	0.036
Phosphorus	0.688	0.752
Manganese	0.94	0.837
Ti.	0.209	0.141
Vanadium	0.046	0.046
Carbon	3.52	3.46

The analysis of the coke gave the following results: Moisture and volatile matter, 1.591 per cent; ash, 11.395 per cent; phosphorus, 0.014 per cent; fixed carbon, 87.013 per cent; sulphur, 0.851 per cent; silica, 6.340 per cent. In the cast from the cupola the metal was medium fluid. The average shrinkage was 0.0868 inch per foot. The results of the tensile tests are as follows:

Mark.	Mean diam., in.	Mean area, in.	Ultimate load, lbs.	Ultimate strength, lbs. per sq. in.
600-A-1	0.7949	0.4963	13,600	27,400
600-A-2	0.7974	0.4994	13,700	27,430
600-A-3	0.7960	0.4976	12,460	25,040
Average				26,620

The detailed results of the transverse tests are as follows:

Mark.	Width, in.	Depth, in.	Ultimate load, lbs.	Modulus of rupture, lbs. per sq. in.
600-A-1	2.02	1.00	2,500	44,550
600-A-2	2.00	1.00	2,930	52,740
600-A-3	2.00	1.00	2,890	52,020
Average				49,770

Figs. 1, 2 and 3 were made from photomicrographs of castings from this iron, magnified 100 diameters. In Fig. 1, the specimen was etched to show the crystal grains of the metal to better advantage and the others were polished to display the graphite. The micrographs would indicate that the iron is remarkably sound and structurally uniform. Fig. 4 shows the fracture of one of the tensile specimens. It shows an iron of fine granular structure. This grade of iron is close grained, easy to machine and polishes fairly well. It seemed to be free from hard spots.

Test of No. 2 Plain, Cast No. 618, Alburtis Furnace, Mark 618-A

This pig was made from a mixture of 66 2/3 per cent Richard ore from The Thomas Iron Co.'s mine at Whar-

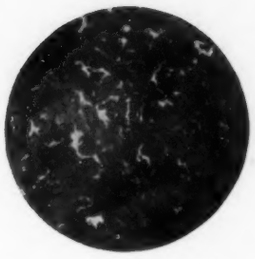


Fig. 1—Specimen No. 600-A-1

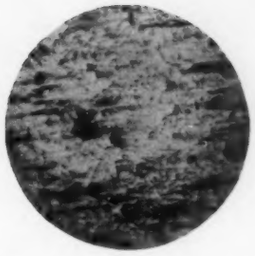


Fig. 2—Specimen No. 600-A-2

Fig. 3—Specimen No. 600-A-3

Fig. 4—Fracture of specimen No. 600-A-2

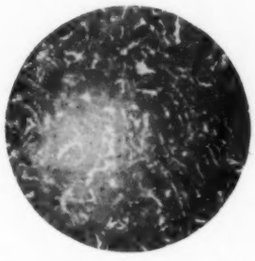


Fig. 5—Specimen No. 618-A-1

Fig. 6—Specimen No. 618-A-2

Fig. 7—Specimen No. 618-A-3

Fig. 8—Fracture of specimen No. 618-A-1

Fig. 9—Specimen No. X1-H-1

Fig. 10—Specimen No. X1-H-2

Fig. 11—Specimen No. X1-H-3

Fig. 12—Fracture of specimen No. X1-H-2

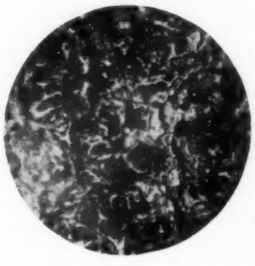


Fig. 13—Specimen No. X2-H-1

Fig. 14—Specimen No. X2-H-2

Fig. 15—Specimen No. X2-H-3

Fig. 16—Fracture of specimen No. X2-H-2

Fig. 17—Specimen No. 3-H-1

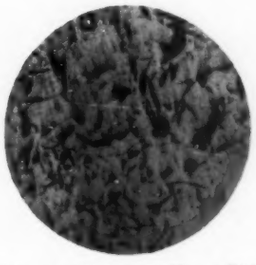


Fig. 18—Specimen No. 3-H-2

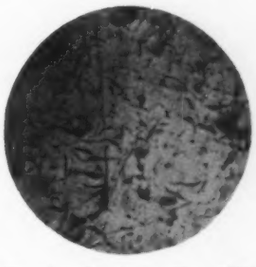


Fig. 19—Specimen No. 3-H-3

Fig. 20—Fracture of No. 3-H-2

Micrographs and Fractures of Vanadium Pig Iron

Insert The Iron Trade Review, July 9, 1914.

ton, N. J., and 33 1/3 per cent local ores. The charge to the cupola consisted of 630 pounds of pig and 350 pounds of coke. No flux was used. The analyses of the pig and castings are as follows:

	In pig.	In castings.
Silicon	1.93	1.881
Sulphur	0.026	0.044
Phosphorus	0.84	0.844
Manganese	0.26	0.386
Ti.	0.190	0.148
Vanadium	0.043	0.040
Carbon	3.41	3.42

The analysis of the coke resulted as follows: Moisture and volatile matter, 1.591 per cent; ash, 11.395 per cent; phosphorus, 0.014 per cent; fixed carbon, 87.013 per cent; sulphur, 0.851 per cent; silica, 6.340 per cent. In the cast from the cupola the metal was hot and fluid with considerable slag. It is believed that the introduction of some scrap would help this. The average shrinkage was 0.0822 inch per foot. The results of the tensile tests are as follows:

Mark.	Mean diam., in.	Mean area, in.	Ultimate load, lbs.	Ultimate strength, lbs. per sq. in.
618-A-1	0.7984	0.5006	8,850	17,680
618-A-2	0.7981	0.5003	8,850	17,690
618-A-3	0.7970	0.4989	9,650	19,340
Average				18,240

The following figures were obtained from the transverse tests:

Mark.	Width, in.	Depth, in.	Ultimate load, lbs.	Modulus of rupture, lbs. per sq. in.
618-A-1	2.03	1.01	2,160	37,560
618-A-2	2.03	1.01	2,120	36,870
618-A-3	2.01	1.01	2,130	37,400
Average				37,280

Figs. 5, 6 and 7 indicate the character of the metal. These micrographs show that the metal is structurally uniform and sound. The fracture of one of the tensile specimens, Fig. 8, indicates a fine, granular gray iron. This iron was easy to machine and takes a fairly good polish.

Test of No. 1X Iron From Hokendauqua Furnace, Mark X-1-H

This pig was made from a mixture containing 25 per cent Richard ore from The Thomas Iron Co.'s mines at Wharton, N. J., and 75 per cent Lake, New York state and local ores. The charge to the cupola consisted of 604 pounds of pig and 350 pounds of coke. No flux was used.

The analyses of the pig and castings are as follows:

	In pig.	In castings.
Silicon	3.28	3.35
Sulphur	0.032	0.048
Phosphorus	0.760	0.736
Manganese	0.74	0.512
Ti.	0.272	0.135
Vanadium	0.041	0.038
Carbon	3.52	3.11

The analysis of the coke follows: Moisture and volatile matter, 1.591 per cent; ash, 11.395 per cent; phosphorus, 0.014 per cent; fixed carbon, 87.013 per cent; sulphur, 0.851 per cent; silica, 6.340 per cent. In the cast from the cupola the metal was hot and fluid and free from slag. The average shrinkage was 0.0822 inch per foot.

The tensile tests resulted as follows:

Mark.	Mean diam., in.	Mean area, in.	Ultimate load, lbs.	Ultimate strength, lbs. per sq. in.
X-1-H-1	0.7999	0.5025	10,820	21,530
X-1-H-2	0.7995	0.5020	10,650	21,220
X-1-H-3	0.8023	0.5056	11,780	23,300
Average				22,020

The transverse tests resulted as follows:

Mark.	Width, in.	Depth, in.	Ultimate load, lbs.	Modulus of rupture, lbs. per sq. in.
X-1-H-1	2.03	1.01	2,120	36,870
X-1-H-2	2.06	1.01	2,190	37,540
X-1-H-3	2.02	1.00	2,260	40,270
Average				38,230

Specimen X-1-H-2 had a small blow hole about 3/8 x 1/8 inch, near the center of the section in the plane of rupture.

In the micrographs, Figs. 9, 10 and 11, specimen X-1-H-1 was etched to show the granular structure of the metal; the others are polished to show the graphite. These would indicate that the metal was uniform in structure and sound. The fracture of one of the tensile specimens is illustrated in Fig. 12. It shows a fine granular gray iron, which was easy to machine and had good polishing qualities. This iron is good for machinery castings, and from experience, I have found that with 40 per cent machinery scrap, this iron gives good results, and takes an excellent polish.

Test of No. 2X Iron From Hokendauqua Furnace, Mark X-2-H

This pig was made from a mixture of 29 per cent Richard ore from The Thomas Iron Co.'s mines at Wharton, N. J., and 71 per cent Lake, New York state and local ores. The cupola charge consisted of 588 pounds of pig and 350 pounds of coke. No flux was used.

The analyses of the pig and castings are as follows:

	In pig.	In castings.
Silicon	2.68	2.492
Sulphur	0.049	0.063
Phosphorus	0.896	0.876
Manganese	0.58	0.58
Ti.	0.226	0.154
Vanadium	0.043	0.040
Carbon	3.65	3.17

The analysis of the coke gave the following results: Moisture and volatile matter, 1.591 per cent; ash, 11.395 per cent; phosphorus, 0.014 per cent; fixed carbon, 87.013 per cent; sulphur, 0.851 per cent; silica, 6.340 per cent. In the cast from the cupola, the metal was hot and fluid and free from slag. The average shrinkage was 0.0868 inch per foot.

The tensile tests resulted as follows:

Mark.	Mean diam., in.	Mean area, in.	Ultimate load, lbs.	Ultimate strength, lbs. per sq. in.
X-2H-1	0.7947	0.4960	10,370	20,910
X-2H-2	0.7986	0.5010	10,150	20,260
X-2H-3	0.7971	0.4990	9,950	19,940
Average				20,370

The transverse tests resulted as follows:

Mark.	Width, in.	Depth, in.	Ultimate load, lbs.	Modulus of rupture, lbs. per sq. in.
X-2H-1	2.01	1.01	2,210	38,810
X-2H-2	2.04	1.02	2,610	44,290
X-2H-3	2.04	1.02	2,600	44,980
Average				42,690

The micrographs, Figs. 13, 14 and 15, indicate that the metal was uniform in structure. The fracture of one of the tensile specimens, Fig. 16, shows a fine granular gray iron which was easy to machine, and had good polishing qualities.

Test of No. 3 Foundry Iron From Hokendauqua Furnace, Mark 3-H

This pig was made from a mixture of 29 per cent Richard ore from the mines of The Thomas Iron Co. at Wharton, N. J., and 71 per cent Lake, New York state and local ores. The cupola charge consisted of 636 pounds of pig and 350 pounds of coke. No flux was used. The analyses of the pig and the castings were as follows:

	In pig.	In castings.
Silicon	1.65	1.505
Sulphur	0.054	0.083
Phosphorus	0.776	0.780
Manganese	0.78	0.386
Ti.	0.172	0.097
Vanadium	0.044	0.038
Carbon	3.72	3.50

The analysis of the coke follows: Moisture and volatile matter, 1.591 per cent; ash, 11.395 per cent; phosphorus, 0.014 per cent; fixed carbon, 87.013 per cent; sulphur, 0.851 per cent; silica, 6.340 per cent. In the cast from the cupola the metal was hot, fluid and free from slag. The average shrinkage was 0.0959 inch per foot. The results of the tensile tests are as follows:

Mark.	Mean diam., in.	Mean area, in.	Ultimate load, lbs.	Ultimate strength, lbs. per sq. in.
3-H-1	0.8013	0.5042	10,410	20,650
3-H-2	0.7991	0.5015	10,290	20,520
3-H-3	0.7990	0.5014	10,390	20,720
Average				20,630

The detailed results of the transverse tests are as follows:

Mark.	Width, in.	Depth, in.	Ultimate load, lbs.	Modulus of rupture, lbs. per sq. in.
3-H-1	2.01	1.00	2,090	37,240
3-H-2	2.03	1.01	2,510	43,650
3-H-3	2.04	1.02	2,300	39,030
Average				39,970

In the micrographs, Figs. 17, 18 and 19, specimen 3-H-1 was etched to show the granular structure of the

metal; the others are polished to show the graphite. These would also indicate that the metal was uniform in structure. The fracture of one of the tensile specimens, Fig. 20, shows a fine granular gray iron, which was a little harder than the others tested, but fairly easy to machine and had fair polishing qualities. This iron would be good for such castings as require a hard, close grain surface.

There are some general characteristics common to these five grades of Thomas iron. The castings are homogeneous, sound and remarkably free from blow holes and other defects; they give fine granular gray castings, which are all easy to machine and take a fair polish; the test specimens showed uniform strength of characteristic proportions for gray iron, with the exception of No. 2 plain, cast 600, from Alburtis furnace, which was a very strong and tough iron, but still of close grain and easy to machine.

The addition of scrap will without doubt add to the polishing qualities of all these grades. From my experience with No. 1X with 40 per cent machinery scrap, this iron takes a good polish, and gives castings which are easily machined.

Vanadium Stays in Iron

The greatest loss in vanadium from the pig iron to the casting was in the No. 3 foundry, where the vanadium dropped from 0.044 per cent to 0.038 per cent. In test No. 600-A, there was no loss in the vanadium, which was 0.046 per cent in the pig iron and 0.046 per cent in the casting. The closeness of the grain and the softness of all the castings under the tool, are characteristic of iron which contains vanadium. In his article on "Vanadium in Pig Iron" (Transactions of American Institute of Mining Engineers, pages 883-886, February, 1912) Dr. P. W. Shimer says that "There is reason to believe that the effect of vanadium on the strength and other qualities of these irons is noticeably beneficial, and titanium probably acts in a similar way. When these elements are present in notable amounts, there is often a peculiar fine-grained structure combined with softness and unusual strength." In this article Dr. Shimer explains why irons containing vanadium are generally finer grained than those irons of similar silicon and sulphur content, which do not have vanadium.

It will be noted that most of the five irons tested were low in combined carbon, and ordinarily would have had coarse grains of graphite.

Electric Substations in Mines

BY H BOOKER

DURING the last few years the use of electricity in mines has attracted a great deal of attention throughout the United States. This is largely due to the large increase in coal consumption making it necessary to discard the early primitive methods of running and to install modern power equipment, without which it would be impossible to produce the required output with the present supply of labor.

Steam and compressed air have been and are still used to a large extent for the power supply at the coal and iron mines, but there is a growing use of electricity especially during the last two or three years, due to the introduction of central station power which, strange to say, can be sold to a mine cheaper than the mine can produce it itself.

The greatest care should be exercised in the introduction of electric power in a coal mine and the very best advice should be obtained before attempting any electric installation about a mine. Electric power improperly installed and not properly operated and maintained will no doubt prove a hazard and it is just such conditions that is causing apprehension in some localities regarding the use of electric power in mines.

The danger and unsatisfactory service associated with electric power in the past, has been largely due to the short sighted policy of mining companies in purchasing cheap equipment unsuited to the service and in employing incompetent labor. A mine is the last place where inferior or poorly designed electrical apparatus should be used, as the risk of trouble is too great.

Even with the best designed and best adapted equipment the question of operation and maintenance is one that is often sadly neglected. The matter of compensation is often allowed to play too prominent a part, and the wages offered are such that it is impossible to obtain competent men who will take proper care of the equipment and who will realize the importance of properly maintaining the apparatus. Rigid, systematic, and careful tests should be made periodically on all moving parts of electrical equipment to insure proper operation and records kept of these tests for future reference.

Warnings Necessary

Warnings regarding the danger of touching wires, cables or electrical apparatus should be from time to time pointed out to all workmen in the mine, and in some way kept constantly before them. The primary cause of the majority of accidents, it is fair to say, is partial or complete ignorance. Those unskilled in electric work should treat all electrical apparatus as alive, as only in so doing lies complete security for them.

The writer proposes to deal with the installation, operation and maintenance of substations around mines from the standpoint of the practical operator. Until quite recently the electric power in use at coal mines was produced by small isolated plants located at each mine. With the large increase in production and the combination of many small mines, the central plant idea and the purchase of central station power is rapidly gaining ground.

The use of power from a central plant, or of purchased power, requires a substation to supply direct current to operate the mine locomotives, cutting machines, underground pumps and lights. A mine substation, in general, consists of one or more motor-generator sets or synchronous converters used to transform high voltage alternating current power to direct current at 250 or 500 volts.

The small isolated plant was generally placed near the pit mouth, provided the coal and water supply was convenient. As the capacity of the mine increased and the distance to the working face became greater the power conditions became quite satisfactory. An increase in the capacity of the existing plant often means a large expenditure of time and money so that the purchase of central station power and the installation of a substation offers the best solution. The substation can generally be placed at a more advantageous point than the isolated plant since a substation is independent of coal and water supply. An increase in power supply at any time can be easily and quickly taken care of at a low cost.

Substations when properly designed

(*Continued on page 98b.*)

In Business for Over a Century

Description of Recent Important Extensions to Works of N. & G. Taylor Co. at Cumberland

EXTENSIVE improvements recently have been made to the works of N. & G. Taylor Co., at Cumberland, Md., including the construction of a new tin-house which takes the place of the finishing plant formerly operated at Philadelphia. The several manufacturing departments of the company have been concentrated at Cumberland, resulting in improved operating conditions, which will tend to enhance the quality of the product. The Taylor company has been identified with the sale and production of tin plate in the United States for over a century, since 1810 to be exact. For many years the company specialized on roofing tin and while at present this class of material forms a large part of the output, at the same time heavy tonnages of tin plate are manufactured for cans and various other purposes. The company controls its own raw materials and the plant at Cumberland is entirely self-contained and completely equipped for the manufacture of all kinds of tin plate.

FIG. 1—FINISHING TIN PLATE AT THE NEW CUMBERLAND WORKS OF THE N. & G. TAYLOR CO.

The works include a steel making department equipped with three 25-ton open-hearth furnaces, a bar mill, a black plate mill, a tin house, a laboratory, machine shop, power house and auxiliary departments. The general arrangement of the plant is shown in Fig. 9. The shops are located in South Cumberland and are reached by both the Baltimore & Ohio and Western Maryland railroads; a connection is also made with the Pennsylvania railroad by means of a short transfer across the town. The property covers some ten acres of high ground overlooking the Potomac river and the Chesapeake & Ohio canal.

Arrangement of the Buildings

The buildings cover a plot of ground approximately 600 feet wide and 800 feet long. The open-hearth department is located at the south end of the property, as shown in Fig. 9, the open-hearth building being about 100 feet wide and 300 feet long. These dimensions include the bar mill which is under the same roof with the open-hearth furnaces. The other main buildings are laid out with their long axes parallel to the open-hearth building. Between the latter and the new tin house is a yard approximately 140 feet wide and 600 feet long which affords ample room for storage purposes. This yard is traversed by an industrial railway and also by standard gage tracks as indicated in Fig. 9. Black plate plant No. 1, located north of the new tin house is approximately 300 feet long and 80 feet wide. Black plate plant No. 2, which is located at the extreme northern end of the works is 180 feet long and 80 feet wide. A boiler house and bar shed are located between these two black plate plants. The arrangement of the various auxiliary buildings is clearly shown in Fig. 9.

Three modern, 25-ton, basic open-hearth furnaces provide ample steel making facilities. The pig iron and scrap for the furnaces are loaded into the charging-boxes by means of a 15-ton, eight-wheel locomotive crane provided with a 45-foot boom and a lifting magnet. The crane was furnished by Orton & Steinbrenner of Chicago, and the magnet by the Electric Controller & Mfg. Co., Cleveland. The

FIG. 2—GENERAL VIEW OF NEW TIN HOUSE, SHOWING SORTING TABLES IN THE CENTER

charging-boxes are handled on narrow gage trucks by means of a steam locomotive which transfers them from the stock yard to the open-hearth charging platform. The material is charged into the furnaces by a Wellman - Seaver - Morgan standard, high type, four-motor charging machine. The pouring bay in the open-hearth building is equipped with a 40-ton, 4-motor, mill type traveling crane provided with a 7½-ton auxiliary hoist, furnished by the Alliance Machine Co., Alliance, Ohio. A 35-ton crane equipped with a 5-ton auxiliary hoist, also was furnished by the Morgan Engineering Co., Alliance, Ohio. A 25-ton Case crane is also installed in the casting bay. The steel is transferred from the furnaces to the ingot molds in 30-ton ladles. The molds are situated in a casting pit as shown in Fig. 6, and the steel enters the molds at the bottom.

The ingots are re-heated in a continuous heating furnace preparatory to being rolled into bars. The rolling equipment includes a 24-inch, 2-high roughing mill, and a 3-high finishing mill both of which were furnished by the United Engineering & Foundry Co., Pittsburgh. The finishing mill is driven by a 32 x 48-inch Hamilton-Corliss engine rated at 750-horsepower. The bar mill, which is fed by hand, has live roller tables, its general arrangement being clearly indicated in Fig. 4. An automatic motor driven runout table carries the finished bars to a No. 2 vertical motor-driven shear built by the United Engineering & Foundry Co., especially for the pur-

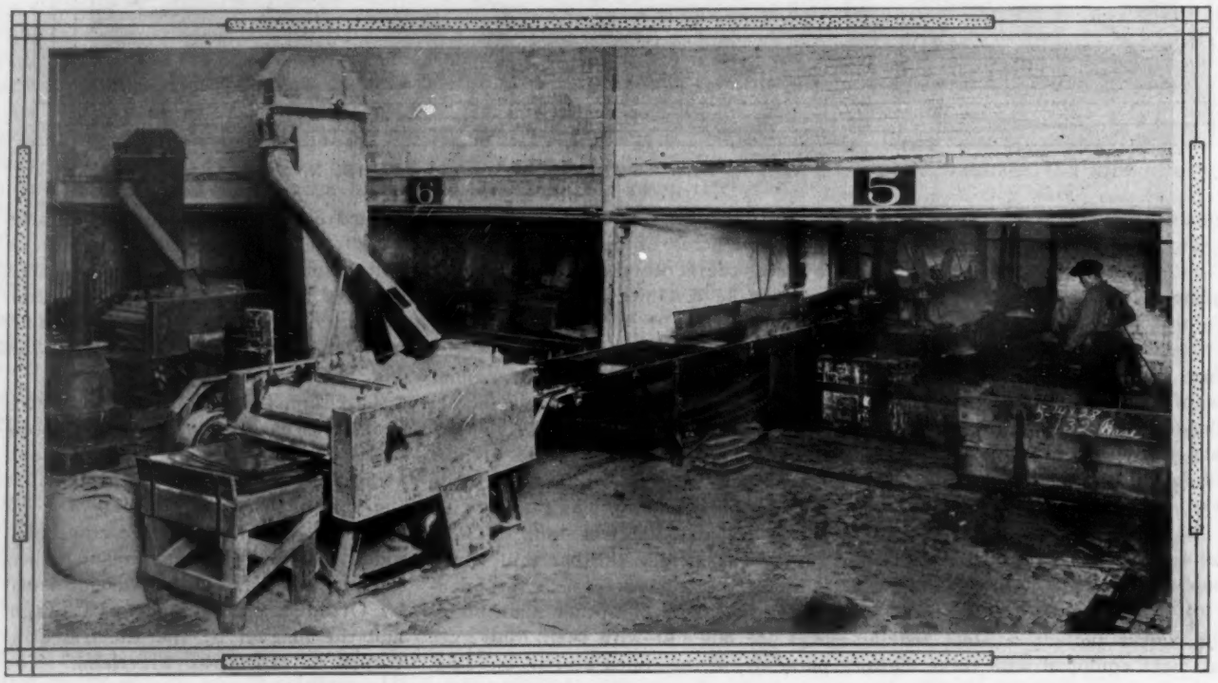


FIG. 3—TINNING AND BRANNING MACHINES IN OPERATION

FIG. 4—ROLLING TIN BARS IN A THREE HIGH MILL

pose of cutting tin bars accurately to short lengths. After shearing, the bars drop into a water bosh from which they are carried automatically by a chain conveyor to transfer buggies; the latter carry the bars to the various hot mills in the blackplate department.

The blackplate department is divided into two sections. Section No. 1 contains three 26 x 30-inch hot mills, and two 26 x 32-inch hot mills direct-connected to a 38 x 60-inch Rarig-Corliss engine. These mills are served by a Mesta high type pickling machine and three direct-fired annealing furnaces. A four-stand cold mill equipped with rolls 22 inches in diameter and 32 inches in length is installed; it is direct connected to a 150-horsepower Rarig-Corliss engine. Three 26 x 30-inch hot mills direct connected to a 450-horsepower engine and two 22 x 32-inch cold stands are installed in blackplate department No. 2. The foundry, a portion of which is shown in Fig. 6, is located adjacent to blackplate plant No. 2. It is equipped with a Whiting cupola and the other appliances which are necessary for making gray iron castings. The foundry is used principally for repair purposes and for casting ingot molds.

A standard three-arm high type Mesta pickling machine is installed in blackplate plant No. 2 and is operated in conjunction with two direct-fired annealing furnaces and the customary array of heating furnaces. Steam for the plant is generated in 72-inch x 20-foot return tubular boilers. Hoppes open-type feed-water heaters of 2,500

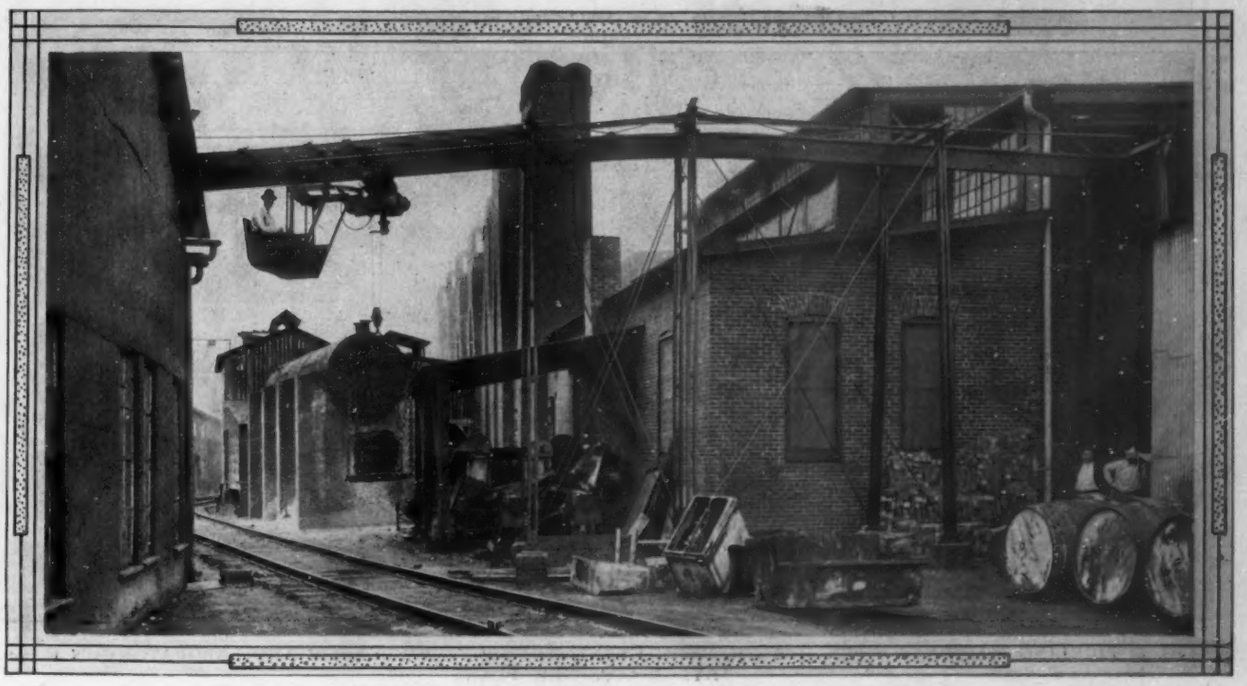


FIG. 5—MONORAIL TRANSFERRING BLACK PLATE TO TIN HOUSE

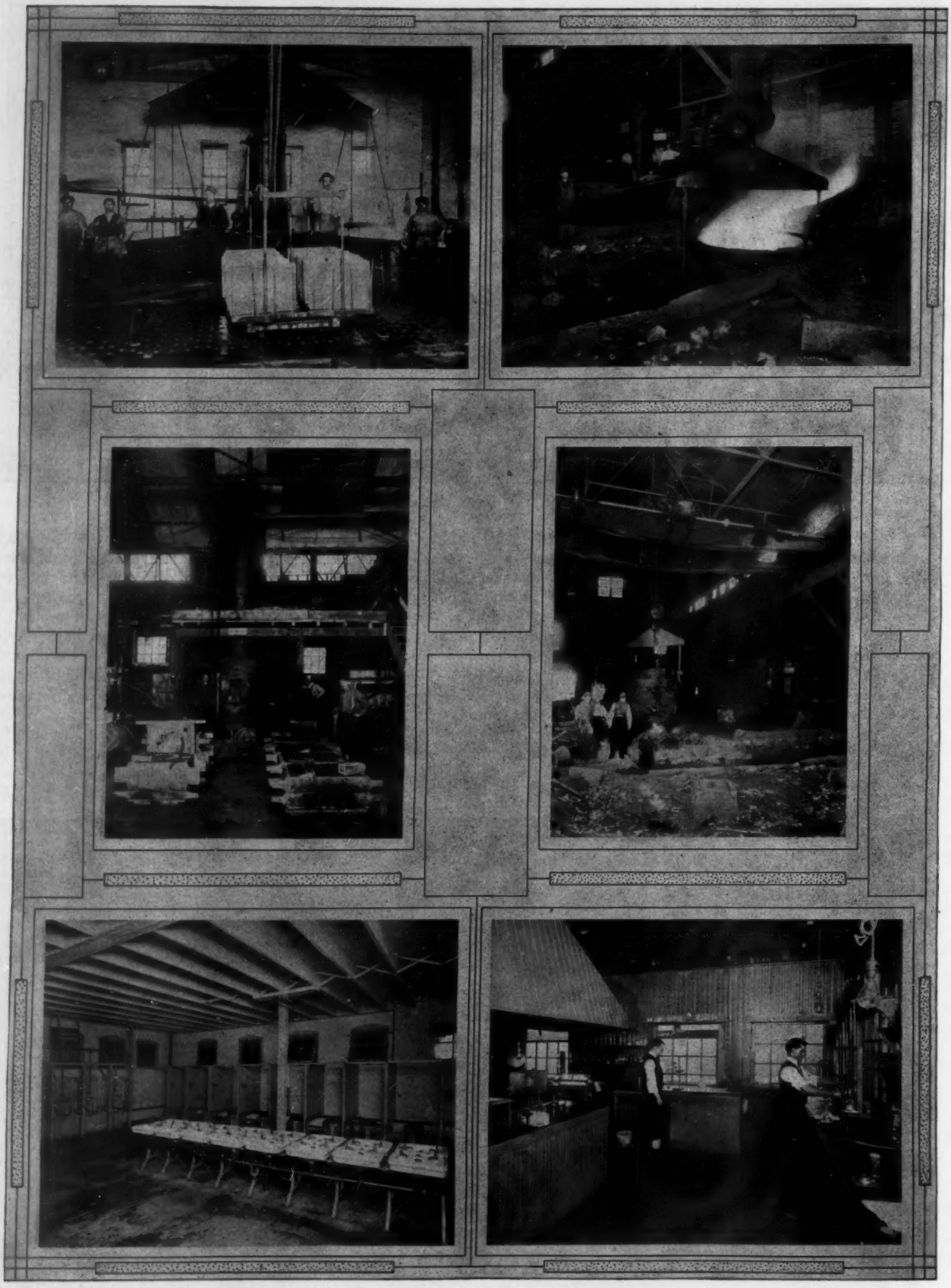


FIG. 6—PICKLING MACHINES, OPEN HEARTH DEPARTMENT, FOUNDRY, WASH ROOM AND LABORATORY IN N. & G. TAYLOR CO.'S NEW PLANT

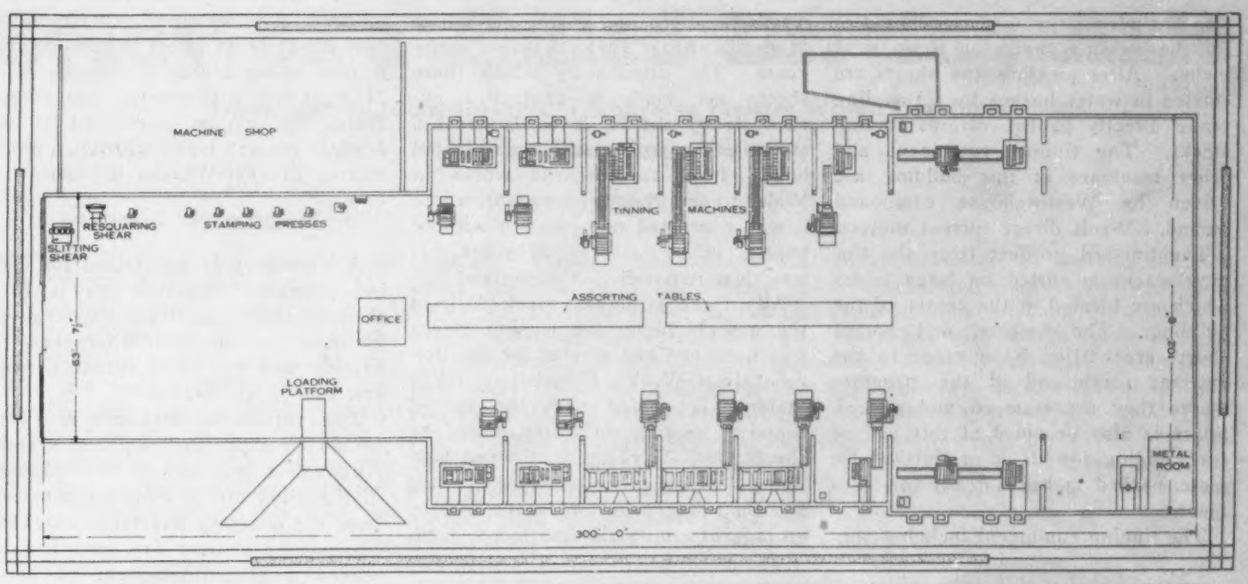


FIG. 7—PLAN OF NEW TIN HOUSE, SHOWING ARRANGEMENT OF TINNING STACKS AND SORTING TABLE

aggregate horsepower have been installed. The boiler feed pumps, which are of the duplex type, were furnished by the Epping-Carpenter Co. and the Laidlow-Dunn-Gordon Co.

An electric mono-rail, Fig. 5, which was furnished by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., is used to transfer the blackplate from the rolling mills to the shipping department or tin house, a distance of about 135 feet. The mono-rail hoist has a lifting capacity of three tons, and a lifting speed of from 13 to 26 feet per minute. It is operated by a 4-horsepower motor. It has a traveling speed of from 250 to 300 feet per minute, using a 2-horsepower motor. The runway is 17 feet above the ground and includes a 45-degree curve.

A number of new ideas are found in the construction of the new tin house, the details of which are illustrated in Figs. 1, 2, 3 and 6. The building, including the pickling room extension and the tinning stacks, is about 400 feet long and 100 feet wide. The center bay is served by a 5-ton Shaw standard 3-motor crane with a span of 60 feet. The full load hoist speed of this crane is 25 feet per minute and the travel speed is 300 feet per minute. All of the motors are enclosed and all of the gearing on the trolleys is completely protected by cast iron covers.

The interior of the building is unusually neat and attractive inasmuch as the crane, the walls and all of the exposed structural steel work are painted white. The roof of the building has been specially designed to provide the maximum amount of light and ventilation; this is secured by alternate high and low bays and the character of the lighting of the interior is fully apparent from the accompanying illustrations. At night the building is lighted by large Adams-Bagnall regenerative flaming arc lamps, and Mazda incandescent lamps.

The stacks in which the tinning machines are located are large and airy and are almost twice the size of the stacks in the company's old works at Philadelphia. They are built of structural steel covered with hollow tile in such a way as to protect the steel members from the heat in case of fire. The stacks are lighted by large windows of fireproof construction furnished by the Lyster Sheet Metal Works, Philadelphia. The sash are glazed with wire glass in accordance with the requirements of the National Board of Fire Underwriters.

The tin house is served by a pickling department equipped with an improved low-type, three-arm pickling machine furnished by the Mesta Machine Co., Pittsburgh. The equipment

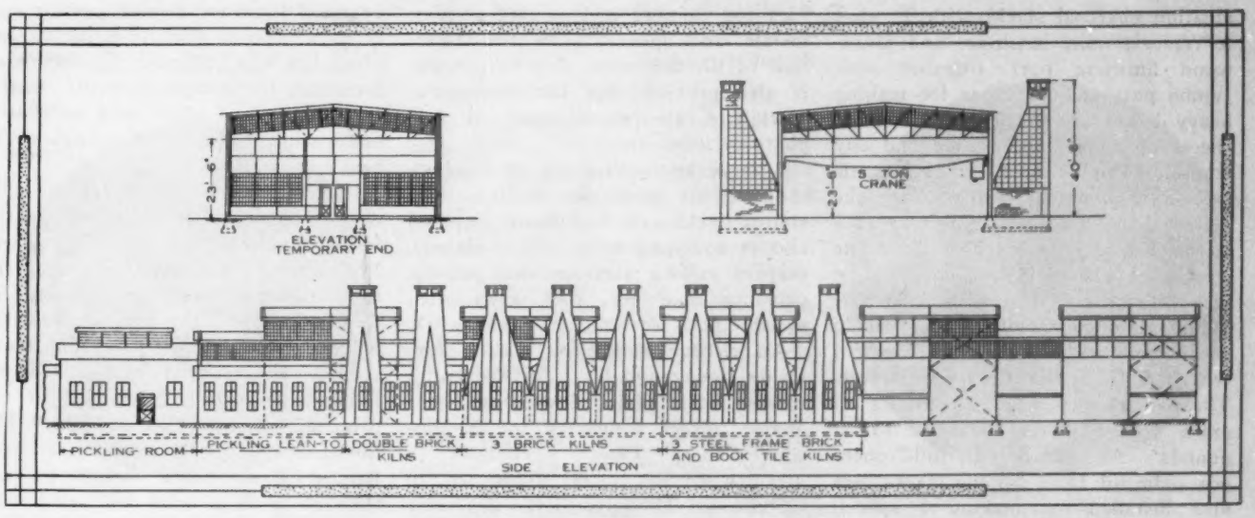


FIG. 8—ELEVATIONS OF NEW TIN HOUSE

also includes large tanks and cradles for the pickling sheets up to 36 x 96 inches. After pickling, the sheets are carried in water boshes by a traveling crane directly to the various tinning stacks. The tinning equipment and other machines in this building are driven by Westinghouse compound wound, 220-volt direct current motors.

The finished product from the tinning stacks is sorted on large tables which are located in the center of the building. The finished and sorted sheets are carried by a crane to the extreme south end of the structure where they are stamped and packed. Space is also provided at this end of the building for stock of finished tin plate, packed in boxes ready for shipment.

The tinning equipment includes combination charcoal stacks with Thomas & White tinning machines and Morewood finishing pots, together with Jumbo pots and machines for making heavy cokes and large tin and terne sheets up to 40 inches wide and any length. Triple machines, automatic catchers and patent cleaners for coke plates have been installed by the Aetna Foundry & Machine Co. The equipment also includes combination terne stacks equipped with Adams & White tinning machines, operated in conjunction with finishing machines of the N. & G. Taylor Co.'s own design. These machines make all grades of extra coated plates from 12 to 50 pounds. A number of "full-7-open-pot, palm oil, hand dipping stacks" are also installed for making a special brand of high grade roofing sheets, which has been one of the specialties of the N. & G. Taylor Co. for many years. The process by which these sheets are made is controlled exclusively by the N. & G. Taylor Co. and the equipment was transplanted bodily from the original works in Wales to the Philadelphia plant, where it was continued in operation without change in method for 20 years. It was then removed to Cumberland.

All of the structural steel work in the new building and tinning stacks was furnished and erected by the Belmont Iron Works, Philadelphia. The building is roofed with the special brand of roofing tin manufactured by the N. & G. Taylor Co. Several auxiliary buildings are grouped around the tin house providing space for the storage of empty tinplate boxes, facilities for refining and mixing coating metals, and apparatus for the reduction of tin and terne drosses. Space is also provided for the storage of blackplate, the manufacture of sulphate of iron, etc.

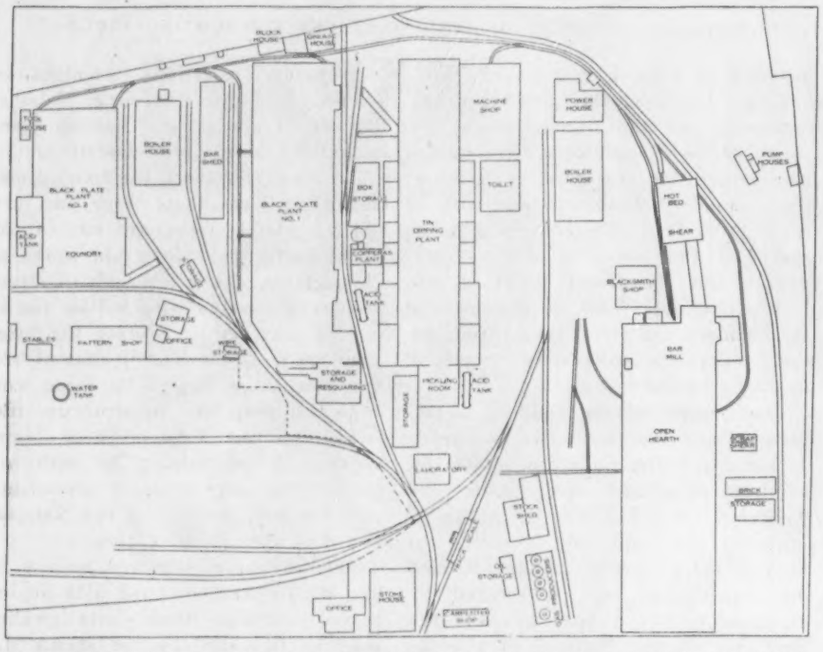


FIG. 9—GENERAL PLAN OF N. & G. TAYLOR CO.'S WORKS AT CUMBERLAND

A large and well equipped machine shop adjoins the tin house. It is used almost exclusively for repair purposes and is equipped with lathes, planers, shapers, milling machines, drill presses, grinding machines, cold saws, etc., suitable both for light and heavy work.

An electric generating station furnishes power and light for the entire works. It is equipped with an Ames engine, direct connected to 150-kilowatt General Electric generator; a McCuen engine, direct connected to 125-kilowatt Thompson-Ryan generator and a Ball engine belted to a 62½-kilowatt Westinghouse generator. A new 300-kilowatt direct connected unit is now being added; it consists of a 24 x 24-inch piston-valve, heavy-duty Harrisburg engine, connected to an 8-pole, engine type, 250-volt, direct current Crocker-Wheeler generator.

Well Equipped Laboratory

A laboratory is maintained for testing purposes. Natural gas is used throughout the plant for all purposes, including the open-hearth furnaces, the heating and annealing furnaces, boilers, tinning stacks, etc.

The various departments are connected by a private telephone system. Although a majority of the buildings of the plant are of fireproof construction, the company has taken extensive precautions against fire, and has installed a full complement of hand-extinguishers and fire-pails, a 40-gallon chemical fire-engine, and a Newman time-detector watchman service throughout the works. The time of the employes is checked by the International time recording system.

In order to attract the best class of workmen to the plant, the comfort of the employes is well provided for by a separate two-story building equipped with plumbing fixtures of the latest improved sanitary type, furnished by the John Douglas Co., Cincinnati. They include washstands with hot and cold water, shower baths, etc.

Company's Growth

The development of the company's business has been an interesting one. It started in 1810 in Philadelphia and continued as an importing business until the McKinley protective tariff on tinplate went into effect in 1893, when the company moved its equipment bodily from Wales to Philadelphia. The Philadelphia plant was operated for a number of years merely as a dipping-works. Some of the blackplate was imported and some was furnished by American mills. Later, the Cumberland plant was purchased and rebuilt to suit the needs of the new owners.

During the past ten years the product of the Cumberland works, in the form of blackplate, was shipped to Philadelphia for tinning. Recently the tinning department was moved to Cumberland. The company's main offices continue at Chestnut and Third streets, Philadelphia and stocks of finished tin plate are carried in the principal cities of the country. The business of this concern has been handed down from father to son through four generations, being now in its one hundred and fifth year.

Study of a Failed Driving Axle

Investigation of an Internal Transverse Fissure Which Developed in Vanadium Carbon Steel

BY ROBERT JOB

THE TYPE of failure known as "internal transverse fissure" has been carefully studied, particularly in connection with rails which have failed in service, and much evidence has been collected as to the prime cause or causes of the defect, as well as to the method of its development.

In view of the importance and the dangerous character of this type of failure, we have taken special interest in the study of a 10-inch driving axle which recently came under our observation. The axle in question was of plain carbon steel, annealed, and said to have had no subsequent heat treatment. It was received in a shipment direct from the manufacturers and had never been in service. Upon receipt at the shops, while a cut was being removed in a lathe prior to mounting, the axle broke in two at a point about 20 inches from the end. The appearance of the fracture was peculiar, showing a band of bright, clean, unoxidized metal around the circumference of the axle and extending about 1 inch toward the center. Inside of this band the surface of the metal was discolored and oxidized. This oxidized condition did not extend into the steel longitudinally, excepting as mentioned below, but was simply an oxidized transverse crack or fissure which extended over the inner portion of the fractured area.

FIG. 1—FRACTURED SURFACE, SHOWING OXIDIZED INTERNAL TRANSVERSE FISSURE WITH BRIGHT METAL AROUND OUTSIDE PORTION

The surface of the transverse crack was rough and irregular, and two longitudinal fissures were found, one across the center of the axle and the other about 1½ inches from the circumference.

The appearance of the fractured surface is shown in Fig. 1, the six round holes indicating the locations from which borings were taken for analysis, from the inside and from the outside portions respectively.

The analyses are as follows:

	Outside.	Inside.
Carbon, per cent	0.48	0.47
Phosphorus, per cent	0.022	0.019
Manganese, per cent	0.46	0.46
Sulphur, per cent	0.036	0.031
Silicon, per cent	0.143	0.161

The chemical composition, outside and inside, is closely alike and is within the usual limits, and does not indicate the cause of failure, and the fact that the proportion of silicon is moderate indicates that no excessive amount of slag was present, although slag inclusions were found.

Test specimens were cut longitudinally from the axle, one from the bright outside portion close to the surface, and one from the oxidized portion about half way between center and circumference. The results of the tension tests are as follows:

	Outside.	Inside.
Tensile strength, lb. per sq. in.	92,340	76,030
Elastic limit, lb. per sq. in.	54,080	45,410
Elongation in 2 in., per cent	14.5	5.5
Reduction of area, per cent.	29.6	12.3

In the outside portion it will be noted that the elongation and the reduction of area of the metal are below normal, while in the inside portion the results indicate radically defective material. In studying the axle a microscopic examination was made from sections cut from the above test specimens with results shown in Figs. 2 and 3, at 50 diameters. From these photomicrographs it will be noted that the size of grain in the outside portion of the axle was coarser than that in the inside portion, and that the size in the inside portion was fairly fine, indicating a proper annealing temperature at that point. A slag inclusion is shown in each of the photomicrographs.

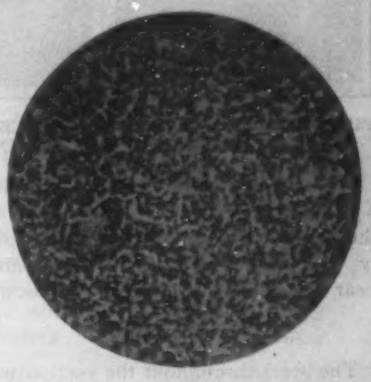


FIG. 3—INSIDE OXIDIZED PORTION ETCHED AND ENLARGED

We next cut a transverse section from the axle close to the point of fracture and on polishing and etching with iodine we obtained the result shown in Fig. 4. In this we found that one side of the axle—the upper part in the figure—was coarse-grained, and a photograph at two diameters of this upper portion is shown in Fig. 5. Fig. 6 is a photograph at two

Presented at the annual meeting of the American Society for Testing Materials at Atlantic City, June 30-July 2.

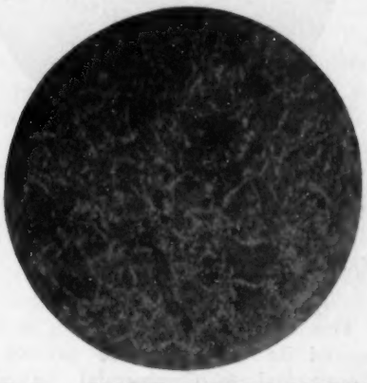


FIG. 2 — BRIGHT OUTSIDE PORTION ABOUT ¼-INCH FROM SURFACE

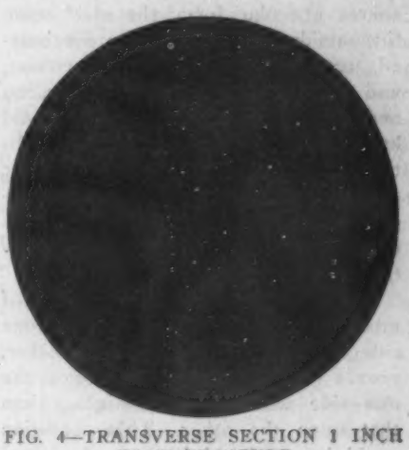


FIG. 4—TRANSVERSE SECTION 1 INCH FROM FRACTURE

diameters taken at the center of the axle, and shows the line of one of the longitudinal fissures, and the fine-grained structure, while Fig. 7, also at two diameters, shows the condition in the lower part of Fig. 4 at the side opposite Fig. 5 and at about the same distance from the circumference as

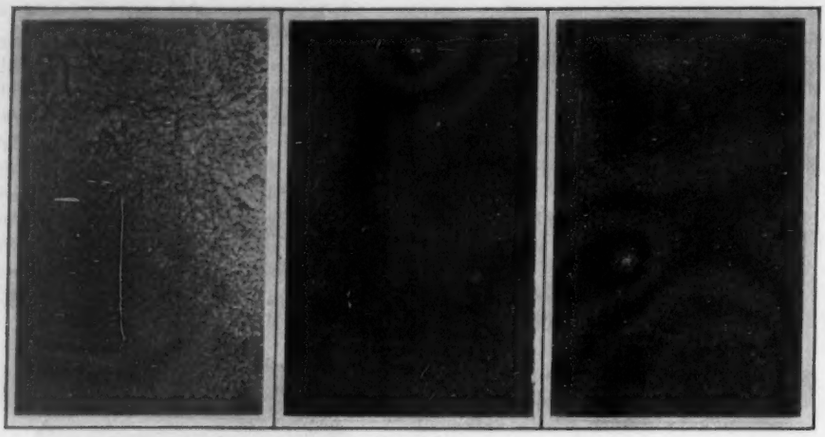


FIG. 5—UPPER OUTSIDE PORTION, SHOWING COARSE GRAIN NEAR SURFACE

FIG. 6—CENTER OF AXLE, FINE GRAIN

FIG. 7—LOWER PORTION OF AXLE NEAR SURFACE

the latter. The granular size is fairly fine, and the gradual coarsening near the surface of the axle is shown.

Steel Was Porous

The steel throughout the section was rather porous and contained occasional small cavities and slag inclusions. Fig. 8, a photograph at 50 diameters, represents the condition at one of these locations. Upon study of the sections shown above, several facts are indicated. In the first place the relatively coarser grain upon the outside surface around the entire circumference than inside proves that the temperature of the annealing furnace was higher than necessary to produce the best results, and in consequence, by the time that the refining temperature had penetrated to the center of the axle, obliterating the original coarse granular form, the steel upon the outside portion had been overheated, causing increased granular size, and resulting in a lower elongation and reduction of area than would have occurred otherwise. This condition, therefore, simply means that the annealing temperature was not properly controlled; in other words, it is evidence of lack of careful mill practice.

Secondly, the fact that the size of grain is decidedly larger upon one side of the axle than upon the other, proves that the temperature upon the one side was decidedly higher than that upon the other. This condition could be produced by use of an unevenly heated annealing furnace, or it would also result provided the axles in the charge after annealing had been cooled unequally in any manner, as, for example, by opening the door of the furnace in the winter, and exposing the adjacent steel to the cold air, thus chilling the side exposed to the cold, while the temperature of the other side was kept up by the other red-hot axles, and by the heat of the furnace. The same condition could also occur if a charge of axles was removed from the annealing furnace when at or above a red heat, and allowed to remain piled together in some location where the outside portion was exposed to cold. The effect would be to chill the side of an axle exposed to water or to cold air, while the other side of the axle in contact with or adjacent to other red hot axles might easily be maintained for a considerable time at a temperature above the critical point of the steel. Under these conditions a decided variation in the size of the grain upon the opposite sides of the axles so exposed could easily result, and owing to the difference in relative rates of contraction, severe torsional strains would be induced which might easily cause rupture of the metal and produce a transverse crack such as is shown in Fig. 1, as well as the longitudinal cracks. The fact that the surface of the transverse fissure was oxidized is easily explained by the presence of the longitudinal cracks, one or both of which evidently extended to the surface of the axle and thus admitted air or moisture to the heated surface of the fissure.

The fact that the steel was porous in spots, and contained slag inclusions, is merely an indication of insufficient cropping to get to sound metal—in other words, defective mill practice; and such condition would naturally result in weakness in the steel and would thus lessen the force necessary to rupture the metal and to produce fissures. The relative weakness and brittleness of the interior portion as shown by the tensile properties is fully accounted for partly by the evident lack of proper cropping at the mill and partly by the intense strains to which the metal had been subjected. The study taken as a whole is of interest, since it proves that an internal transverse fissure may be produced in metal in the mill and as a result of severe stresses induced by defective mill practice.

Plans English Plant

Charles T. Schoen, inventor of the Schoen pressed steel wheel, is planning to establish a plant at Leeds, England, to serve the markets of Great Britain and the Continent, according to a dispatch from Wilmington, Del., where he recently conferred with machinery manufacturers regarding the equipment for such work. Mr. Schoen heretofore has been having his steel wheel manufactured for the European markets by a forging company of Leeds. Complete details of the new plant yet are to be worked out.

Buys Machine Screw Co.

The Hampden Machine Screw Co., Springfield, Mass., has been purchased by the Ansonia Mfg. Co., Ansonia, Conn. The business and equipment of the Hampden company will be moved to Ansonia immediately. Archibald R. Lemieux, who was secretary and manager of the Hampden Machine Screw Co., becomes general manager of the Ansonia Mfg. Co.

FIG. 8—POROUS STEEL

The Gray Screw & Bolt Co. has moved its Chicago office to 1887-89 Continental & Commercial National Bank building.

Many Changes in Specifications

Testing Society Receives Important Committee Reports and Discusses Papers of Unusual Interest

In number, and probably also in importance, the new and revised standard specifications for iron and steel products adopted at the seventeenth annual meeting of the American Society for Testing Materials, held at Atlantic City, June 30 to July 3, greatly exceeded those considered at any previous convention of this organization. Drastic changes were made in the standard specifications for forgings and the two standards for Bessemer and open-hearth rails were merged into one new specification for carbon steel rails. Six new standards were adopted, including three specifications for structural steel for cars, carbon steel bars for railway springs and cold-drawn Bessemer steel for automatic screw stock; the recommend practice that received the approval of the society includes heat-treatment of case-hardened carbon steel objects and annealing carbon steel castings and new standard methods of chemical analysis for plain carbon steel also were adopted. Sixteen iron and steel specifications were revised, and so numerous were the changes in the forging standards, that these were almost entirely rewritten. The work of Committee A-1, on standard specifications for steel, accomplished during the past year, was a tremendous achievement that met with the hearty approbation of the society and its activity is reflected by the report of its three meetings which involved a total of eight sessions.

Probably of greatest importance of the topics considered at this meeting was the suggestion made by Secretary-Treasurer Marburg that the letter ballot on new and revised specifications be eliminated. He directed attention to an experience of 14 years in the work of the society, during which period every proposed standard that survived the cross-fire at annual meetings had been approved on letter ballot by a substantially unanimous vote. The average total vote on the 32 proposed standards submitted to letter ballot a year ago was only 95 from among a membership of 1,620, the average affirmative and negative vote, having been 92 and 3, respectively.

The suggestion for the elimination of the letter ballot was contained in a paper entitled "A Critical Review of the Procedure Governing the Adoption of Standards," and the discussion indicated that opinions among the members are at wide variance and that the subject must be approached carefully to maintain the high standard with which the specifications of the society are now considered. The suggestions of Secretary-Treasurer Marburg will be considered by the executive committee and a report undoubtedly will be submitted next year.

A new high record for attendance was established, and the interest manifested in the proceedings by representatives of both producers and consumers reflected the importance attached to the work of the society by manufacturers throughout the United States and Canada.

A VOLUMINOUS report, consisting of 106 printed pages, in small measure reflected the tremendous amount of work done during the year by Committee A-1 on standard specifications for steel. Eleven specifications for various steel products were revised, five were cancelled and superseded by four revised standards. Two new specifications proposed were adopted by the members and referred to letter ballot and a new standard method of Chemical Analysis for Plain Carbon Steel was adopted.

Since the last annual meeting the membership of this committee was increased from 93 to 108, comprising 71 non-producers and 37 producers. Committee A-1 now has 15 sub-committees in which a number of changes have been made. The most important was the merging of the sub-committees on axles, forgings and on blooms, billets and slabs, into a new sub-committee on forgings, to which have been added the members of the former sub-committee on locomotive materials interested in forgings. A new sub-committee on methods of physical tests has been created.

The interest manifested in the meetings of Committee A-1 is reflected by the large attendance at the eight sessions of the three meetings held during the year. At each meeting there was an average attendance of 46, representing 40 members. The sub-committees have held 24 meetings with an estimated total attendance of 250 members and guests. The sub-committee on forgings, consisting of 31 members, held six meetings, with an average attendance of 27; two of the six meetings occupied two days, and including evening sessions, practically 9½ days were spent by this sub-committee in revising the forging specifications.

Specifications for Rails

The society's standard specifications for Bessemer and for open-hearth steel rails were cancelled and have been superseded by specifications for carbon steel rails, which are in agreement with those of the American Railway Engineering Association, one specification covering both Bessemer and open-hearth rails. The principal revisions in the specifications on rails adopted by the society, follow:

Rails up to 120-pound in section have been provided for and the carbon and manganese contents in Bessemer rails have been increased slightly. The carbon content of some sections of open-hearth rails also has been slightly increased. In the former specifications the drop test was made to guard against brittleness only, the acceptance or rejection of a heat having been determined by the success or failure of two tests out of three in standing the drop test.

The new specifications, in addition to providing a test for brittleness, incorporate determinations of the ductility or toughness as opposed to brittleness, and also soundness. One test piece is selected from the top end of the top rail of each Bessemer heat and three from each open-hearth heat. The failure of the top rails to meet the specifications does not reject the entire heat, but only the A rails, arrangement being made to progressively test pieces from the top of the B and C rails in this case. In case of failure of the B test the heat is accepted or rejected, depending upon whether the tests from C rails pass or fail to pass the requirements. If, however, the tests outlined show only interior defects and meet the other requirements, the rails which they represent will be accepted as "special" rails.

The former specifications provided for the stipulation of a fixed minimum discard, subject to agreement, from the upper part of the ingot, while the

new specifications require sufficient discard to secure sound rails without fixing a minimum discard.

Rail Lengths

The former specifications established the standard length as 30 or 33 feet; the new specifications recognize one standard length, 33 feet. A variation of ¼ inch in length from that specified was permitted by the former specifications, while the new specifications, in addition to this tolerance, permit a variation of ⅜ inch for 15 per cent of the order.

A variation of 1/32 inch larger than the specified size of holes is permitted by the specifications, which also contain a paragraph rejecting all rails which show interior defect at either end, or in any drilled hole. While this was implied in the former specifications, it was not specifically stated.

With the exception of the following features, the new specifications are identical with those of the American Railway Engineering Association.

Provision has been made for rails between 50 and 70 pounds and 100 and 120 pounds in weight. Rails adjoining test pieces which have shown the presence of interior defects are marked as special to be used at the discretion of the purchaser, instead of being rejected; a change has been made permitting the use of retest from the bottom of the top rail instead of the top of the second rail, and from the bottom of the second rail instead of the top of the third rail, in order to prevent destroying full-length rails. This change is an additional safeguard for the purchaser, as well as being desirable from the manufacturer's standpoint. In the case of rails over 100 pounds in weight the distance between supports in the drop-testing machine has been increased to 4 feet, because it has been indicated by experiment that the shorter distance between supports results in a shearing action on the rails rather than a full opportunity to develop the ductility.

Splice Bars

The most important change made in the splice bar specification relates to camber in both planes and its direction in a horizontal plane. The paragraph covering this feature, follows:

For splice bars for girder and high tee rails, any variation from a straight line in a vertical plane shall be such as will make the bars high in the center, and the maximum camber in this plane shall not exceed 3/64 inch in 24 inches. Any variation from a straight line in a horizontal plane shall be such as will make the bars convex toward the web of the rail, and the maximum camber in this plane shall not exceed 1/16 inch in 24 inches.

Specifications for heat-treated splice bars and bolts also are under consideration and may be reported next year.

The new specifications for standard steel for cars, adopted and referred to letter ballot, were modeled upon the present specifications for structural steel. They provide for shapes, plates and bars over ⅛ inch in thickness, with a range in tensile strength from 50,000 to 65,000 pounds per square inch.

The specifications for structural steel for bridges and buildings were changed by making a new range for tensile strength which now is from 46,000-56,000 pounds per square inch. The specifications for structural steel for bridges, for structural nickel steel and for structural steel for buildings, have been revised to eliminate definite reference to forgings, in order to harmonize the present specifications in this respect with the new specifications for forgings.

The requirements for eye bars for bridges have been revised: (1) To include bend tests of unannealed eye-bar flats; (2) to permit the purchaser to determine and specify the tensile strength to be obtained in specimen tests of the unannealed bars, up to a maximum of 74,000 pounds per square inch, to meet the required minimum tensile strength of the full-size annealed eye-bars. This is in line with the practice followed in the specifications for steel railway bridges of the American Railway Engineering Association. Owing to the fact that tests of angles are unnecessary and are seldom called for, these have been omitted from the specifications in which they occur. The specifications for shapes, universal mill plates and bars for locomotive materials were revised with a view of making them consistent as to form, and in part as to substance with the new specifications for structural steel for cars, and particularly of providing for sheared plates. These specifications, however, are not intended to apply to boiler and firebox plates.

Carbon Steel for Springs

The new specifications for carbon steel for springs, which were drawn to apply to automobile as well as railway springs, were changed to apply to railway springs only, owing to a conflict in requirements with other standards for automobile springs. In presenting its report, the committee directed attention to the omission of a silicon requirement from these specifications, which is due to the fact that the presence of this element has not yet been conclusively shown to be of essential or of definite value. The committee also has under consideration the preparation of specifications for alloy steels for springs.

Specifications for billet steel concrete reinforcing bars were changed to provide for an intermediate grade of billet steel reinforcement bar, between the structural steel and the hard grades. The requirements as to tensile properties for the new intermediate grade follows:

	Plain bars.	Deformed bars.
Tensile strength, lb. per sq. in.	70,000–85,000	70,000–85,000
Yield point, minimum, lb. per sq. in.	40,000	40,000
Elongation in 8 in., minimum, per cent	1,300,000	1,125,000
	Tens. str.	Tens. str.

The bend test for this intermediate grade follows:

	Plain bars.	Deformed bars.
Under ¼ in.	180 deg. d = 2t	180 deg. d = 3t
¼ in. or over	90 deg. d = 2t	90 deg. d = 3t

Steel Forgings and Billets

The former standard specifications for steel forgings, for heat-treated carbon steel axles, shafts and similar objects, and for steel forgings for locomotives were cancelled and have been superseded by revised standard specifications for carbon steel and alloy steel forgings, for quenched and tempered carbon steel axles, shafts and other forgings for locomotives respectively, and the former specifications for cold-rolled steel axles and carbon steel car and tender axles were revised.

A factor table and curve for elongation and reduction of area was included in the report which gives values of the percentages of elongation and reduction of area based on the inverse ratio of the tensile strength, that is, factor ÷ tensile strength, for values of tensile strength from 50,000 to 100,000 pounds per square inch and values of the factor from 1,000,000 to 5,000,000. The ductility requirements in the revised specifications for forgings have all been expressed in this way.

The more important changes made in the specifications for carbon steel and alloy steel forgings, follow:

The title and classes have been changed.

Manufacture.—Requirements as to discard and boring have been added, as well as a description of the heat treatment specified.

Chemical Properties and Tests.—The phosphorus and sulphur requirements have been changed, and manganese requirements added.

Physical Properties and Tests.—The classification by sizes has been

changed; the ductility requirements are now based on the inverse ratio of the tensile strength, that is, factor ÷ tensile strength; bend tests have been omitted; and the requirements as to number of tests have been changed.

The more important changes in the new specifications for quenched and tempered carbon steel axles, shafts and other forgings for locomotives and cars, made in the specifications for heat-treated carbon steel axles, shafts and similar objects, follow:

The title has been changed.

Manufacture.—The description of the heat treatment has been changed, as well as the section on prolongations for tests; the section on warping has been omitted; and requirements as to boring have been added.

Chemical Properties and Tests.—The manganese requirements have been changed; and maximum and minimum limits for carbon have been given.

Physical Properties and Tests.—Classification by sizes has been added; the ductility requirements are now based on the inverse ratio of the tensile strength, that is, factor ÷ tensile strength; the method of determining the "elastic limit" has been changed; a section providing for proof tests of finished forgings has been added; the requirements as to number of tests have been changed; and requirements as to character of fracture and permissible re-quenching have been added to the section on retests.

Attention is directed to the following: (1) That many sections in these specifications are the same as the corresponding ones in the proposed revised specifications for carbon-steel and alloy-steel forgings; (2) that the tensile properties are the same as those of the corresponding class in the last-named specifications; and (3) that certain requirements have been included that are not covered in the last-named specifications.

The following changes have been made in the standard specifications for carbon steel forgings for locomotives:

The title and the section on basis of purchase have been changed.

Manufacture.—Requirements as to discard and prolongations for tests have been added, and the description of the heat-treatment has been changed.

Chemical Properties and Tests.—Maximum and minimum limits for manganese have been specified.

Physical Properties and Tests.—Classification by sizes has been added; the ductility requirements are now based on the inverse ratio of the tensile strength, that is, factor ÷ tensile strength; the bend test has been omitted; the requirements as to number of tests have been changed; and requirements as to character of fracture and re-annealing have been added to the section on retests.

As in the case of the revised specications for quenched and tempered forgings, many sections in the revised specifications for carbon steel forgings for locomotives are the same as in the corresponding sections in the revised specifications for carbon-steel and alloy-steel forgings, and the tensile properties are the same as those of the corresponding classes in the last-named specifications.

The sub-committee on forgings has under consideration the preparation of specifications for chrome-nickel, chrome-vanadium and other alloy steel forgings, with the view of writing them into the specifications for carbon steel and alloy steel forgings. The sub-committee also has been changed with the drafting of specifications for steel chain for cars and heat-treated knuckle pivot pins.

Minority Report on Forgings

A minority report submitted by the American Electric Railway Engineering Association, signed by Norman Litchfield, representative, and J. P. Barnes and W. E. Johnson, special representatives, was appended to the report of Committee A-1. The minority report had specific reference to the revised specifications for quenched and tempered carbon steel axles, shafts and other forgings for locomotives and cars, the title of which was sought to be changed to "Standard Specifications for Quenched and Tempered Carbon Steel Axles, Shafts and Other Forgings for Locomotives and Trailer Axles for Cars", in this way excluding electric motor driving axles and armature shafts. A motion to this effect made at the meeting of the committee was defeated and the minority report then was prepared for the consideration of the society.

With reference to the new specifications, the minority report contained the following:

While in some respects the new specifications are an improvement over the existing specifications, they do not, in the main essentials, retain the high standard set by the original specifications, particularly with reference to the elongation and reduction of area, required to be not less than 22 and 45 per cent, respectively, for all tensile strength above a minimum of 85,000 pounds per square inch. It is proposed to place the elongation and reduction of area on a sliding scale basis, such that with a tensile strength of 85,000 pounds, an elongation of 23.5 per cent is permitted as a minimum, with 91,000 pounds, 22 per cent as a minimum, and with 97,000 pounds, a minimum of 20.6 per cent, as the ultimate limit is reached; and with the tensile strength of 85,000 pounds a minimum reduction of area of 44.7 per cent is permitted, with a tensile strength of 90,000 pounds, a reduction of area of 42.2 per cent is permitted, scaling down to a minimum of 39.2 per cent for a tensile strength of 97,000 pounds; covering forgings of various sizes within the range of standard driving axles for electric railway work.

While it is frankly admitted that in no instance will the minimum reduction requirements of the proposed specifications be as high as those of the present specifications, it is claimed by certain members of Committee A-1 that the above arrangement should actually result in a higher minimum requirement for the elongation than that called for in the present specifications for this class of material. We do not agree with this contention, and base our opinion in this respect on experience which has shown us that even with the incentive to keep the tensile strength low in order to meet the elongation and reduction requirements of the present specifications, in the majority of cases the tensile strength exceeds 91,000 pounds per square inch. Moreover, in the specifications as proposed, the tendency will not only permit of a reduced elongation and reduction requirement, but will also result in a lower elastic ratio.

In presenting the report, W. E. Johnson said that if the specifications are adopted without the desired change, they will not be recognized by the American Electric Railway Engineering Association. On the other hand, it was stated that the Pennsylvania railroad will adopt these specifications as applying to axles for cars for its electric trains. After considerable discussion, in which it was stated that the request of the American Electric Railway Engineering Association was given careful consideration by the committee, the minority report, offered in the form of an amendment, was lost by an over-

A. W. Gibbs

With the election of A. W. Gibbs as president, the American Society for Testing Materials has again invaded the railroad engineering field in the selection of its chief executive. Mr. Gibbs is chief mechanical engineer of the Pennsylvania Railroad Co., with headquarters at Philadelphia. After receiving his degree at the Stevens Institute of Technology, Mr. Gibbs served an apprenticeship at the Altoona shops of the Pennsylvania railroad which was followed by 12 years' service in the south in the capacity of master mechanic of the Richmond & Danville and the Central Railroad of Georgia. In 1893 he returned to the Altoona shops of the Pennsylvania railroad, in charge of the testing department and in 1902 he was appointed superintendent of motive power of the Philadelphia, Baltimore & Washington railroad. The following year Mr. Gibbs was appointed general superintendent of motive power of the Pennsylvania railroad with headquarters at Altoona and in 1911 he was made chief mechanical engineer.

For many years Mr. Gibbs was closely in touch with the work done by the late Dr. C. B. Dudley who was affiliated with the testing department of the Pennsylvania railroad for many years. Mr. Gibbs always has taken an active part in the committee work of the American Society for Testing Materials and is a member of the Master Car Builders' and the American Railway Master Mechanics' Association.

whelming vote of the members in attendance at the meeting and the specifications as proposed were adopted and referred to letter ballot of the society.

Steel Castings

At the last annual meeting of the society, Committee A-1 was instructed to report upon the question of an allowance of 10 per cent excess on check analysis for sulphur for castings for railway stock. The present specifications for steel castings specify 0.05 per cent sulphur on check analysis, no excess being allowed. No change in the present requirement was recommended, although the question again will be considered during the ensuing year.

The present specifications for automobile carbon and alloy steels will be revised during the year to make the requirements for forgings agree in general with the revised forging specifications adopted.

Methods of Chemical Analysis

New standard methods of chemical analysis for plain carbon steel were adopted and include the determinations of carbon by the direct combustion and colorimetric methods; determinations of manganese by the bismuthate and persulfate methods; determination of phosphorus by the molybdate-magnesia and alkalimetric methods; determination of sulphur by the oxidation and evolution-titration methods; determination of silicon by the nitro-sulphuric and the sulphuric acid methods; determination of copper; determination of nickel by the gravimetric and volumetric dimethlgyloxime methods, and the determination of chromium.

In the compilation of these standard methods of chemical analysis the committee had the co-operation of 92 laboratories, comprising 51 iron and steel companies, 26 railroad companies and 15 testing and inspection laboratories. In presenting its report, the committee directed attention to the following:

In the case of carbon, manganese, phosphorus, sulphur and nickel, two methods are outlined, one to be applied for work requiring the highest refinement, the other for routine work. For silicon two methods are given, both being capable of giving results of highest accuracy and, therefore, of equal merit from this standpoint. The sulphuric acid method is given, due to its very general application in the laboratories of steel makers. For copper and chromium two procedures are shown, one to be followed for slight traces, the other where the contents are larger.

In the selection of methods, first consideration has been given to the degree of refinement capable in their application, it being recognized that methods for application in cases of conflicting results—that is, standard methods—should represent the highest degree of refinement in the light of existing information. Next in importance the element of time involved in the determination has been carefully considered, and lastly the element of cost incident to the application of the method.

For phosphorus and sulphur the gravimetric methods are suggested for results of highest refinements. It should be stated, however, that the widely used alkalimetric method for phosphorus, and the evolution-titration method for sulphur, are capable of highly satisfactory refinement when skillfully applied.

With reference to the suggested methods for copper, nickel and chromium, prominence should be given to the statement that the outlines presented are intended for application where these elements occur as "accidental" impurities, and not for alloy steels.

Methods of chemical analysis for alloy steels are under consideration as well as the standardization of methods of obtaining drillings for ladle analysis. The sub-committee has collected some interesting information showing the various types and sizes of test ingots used by about 50 steel manufacturers, the position and the number per melt of various sizes, the position and size of the drill hole, and the general procedure in taking drillings for analysis. The investigation will be continued during the coming year, with the co-operation of certain steel companies and the bureau of standards.

The sub-committee on methods of physical tests recommended three clauses for insertion in various specifications, which revise the present requirements for retesting 2-inch tension test specimens which break outside the gage length, the section applying to 2-inch specimens, 8-inch specimens and 2 and 8-inch specimens.

The committee announced its purpose to consider the following questions during the ensuing year: (1) The drafting of general specifications for rivets, with a review of the sulphur requirements for rivet steel; (2) the question of whether the requirements as to chemical composition shall be expressed as "rejection limits" or as ladle analysis requirements with an allowable excess on check analysis by the purchaser; and (3) certain questions of form affecting the sections on "Inspection and Rejection".

At a special meeting of Committee A-1, the following officers were reelected: C. D. Young, engineer of tests, Pennsylvania railroad, chairman, and C. L. Warwick, University of Pennsylvania, secretary.

Committee A-2, on standard specifications for wrought iron, recommended several minor changes in the standard specifications for staybolt iron, which were referred to letter ballot. The committee also recommended that the present standard specifications on engine bolt iron, refined wrought iron bars, staybolt iron and lap-welded iron boiler tubes be classed as applicable to locomotive construction. This recommendation also will be referred to letter ballot.

Locomotive Cylinders

Committee A-3, Dr. Richard Moldenke, chairman, offered a revised set of standard specifications for locomotive cylinders, to supersede the present standard. The revised standard specifies that locomotive cylinders shall be made from good quality, close-grained gray iron cast in a dry sand mold; drillings taken from the fractured end of the transverse test bars shall not run more than 0.90 per cent in phosphorus, nor more than 0.12 per cent in sulphur, and the test bars, when placed horizontally upon supports 12 inches apart and tested under a centrally applied load, shall show an average transverse strength of not less than 3,200 pounds and an average deflection of not less than 0.09 inch. The test bars, as specified, are to be 1¼ inches in diameter at the top, with the bottom 1/16 inch smaller, to allow for draft and for the strain of pouring. The bars are to be cast vertically in a dry mold, and shall not be removed from the mold until cold. They shall be brushed clean, since it has been found that tumbling considerably increases the strength. The iron also is to be subjected to a chill test.

One of the features of this report which aroused considerable discussion was the specification providing that test bars shall be poured from the top. Among those who favored this method of pouring were Walter Wood, S. V. Hummings, Jos. E. Johnson Jr., and Thomas D. West. The only protesting voice was that of Dr. Leonard Waldo, who claimed that top-poured test bars are not apt to be as homogeneous as those poured from the bottom. The committee's report finally was accepted, to be referred to the society for letter ballot.

Dr. Moldenke also submitted a report of the efforts which have been made to establish international specications for pig iron, test bars for cast iron, and for cast iron pipe and fittings. At a meeting in Brussels, Dec. 5, 1913, Dr. Moldenke reported representatives of practically all the producing countries, with the exception

of England, which did not have representatives present, agreed on proposed specifications which are to be submitted to the International Association for Testing Materials. These specifications, he said, are the results of compromises by the representatives of the various countries, and are not recommended to apply to business within these countries, but are intended merely to apply to export business.

Committee A-6, on the magnetic testing of iron and steel, submitted a brief report recommending several minor amendments to the standard magnetic tests of iron and steel, published in the 1913 year-book. This report was accepted to be referred to letter ballot.

Heat Treatment of Steel Castings

Dr. Albert Sauveur, chairman of Committee A-4, on the heat treatment of iron and steel, submitted a "Proposed Recommended Practice for the Annealing of Carbon-Steel Castings". This was accepted by the society to be referred to letter ballot. That section of this committee's 1913 report referring to a "Proposed Recommended Practice for the Heat Treatment of Case-Hardened Carbon-Steel Objects", which was drawn up too late to be acted upon last year, also was adopted.

Committee A-8, on standard specifications for cold-drawn steel, recommended that the tentative specifications advanced last year, for Bessemer automatic screw stock, should be adopted as standard. These specifications, it was reported, had been tested extensively during the year and had proved entirely satisfactory. With reference to the tentative specifications for open-hearth automatic screw stock, advanced last year, the committee reported that they had not yet been tried out with sufficient thoroughness to justify their adoption as standard, and it, therefore, was recommended that they be held over tentatively until next year. The committee, however, announced one change in the tentative specifications, establishing the desired sulphur content of the steel as 0.075 to 0.12 per cent, in place of 0.075 to 0.15 per cent. The recommendation of the committee, including this minor alteration, was accepted by the society.

Effects of Simple Overstrain

Considerable discussion followed the presentation of a paper by Dr. Henry M. Howe, entitled "Are the Effects of Simple Overstrain Monotropic"? Dr. Howe pointed out the need of further study to show whether the strengthening effect of prior overstrain, by cold-rolling, cool-rolling, wire-drawing, etc., is effective or fictitious as regards the endurance of reflective stresses, whether of constant or of reversing sign. Among the representatives of the steel manufacturers present, the opinion seemed to prevail that the paper questioned the advisability of cold-rolling various forms of steel.

George E. Thackray, of the Cambria Steel Co., directed attention to the well-known differences in properties between hot-rolled and cold-rolled steel and cited electric street railway axles and cables of large diameter which have given excellent results in spite of millions of repititive stresses. He pointed out that either hot or cold-rolled material, if subjected to stress and allowed to rest will readjust itself. He added that the purpose of hammering and rolling steel is for the purpose of improving its properties and in conclusion stated "What we are doing when we are operating rolling mills is to work the material".

Physical Properties of Bars

To ascertain the differences in the physical properties of cold-rolled bars shortly after rolling, after they have been at rest for a year and the affect of annealing at 600 degrees Cent., J. S. Macgregor, of Columbia University, conducted an interesting series of tests, the results of which were presented to the society. Three specimens of cold-drawn steel, containing carbon, 0.4 to 0.5 per cent, were cut in halves and three bars were tested immediately, while the other three were annealed at 600 degrees Cent., and after aging for more than a year, were tested to ascertain whether there had been any change in the physical properties.

The results of these tests follow:

	First three bars tested.	Bars annealed and aged.
Elongation, per cent.....	13.2	16.5
Reduction of area, per cent	29.3	34.5
Yield point, lb. per sq. in.	68,277	73,893
Ultimate strength, lb. per sq. in.	104,173	97,273

The annealed and aged bars showed an increase in elongation of 3.3 per cent; increase in reduction of area, 5.2 per cent; increase in yield point, 5,616 and decrease in ultimate strength, 6,900 pounds.

Several weeks ago Mr. Macgregor received three cold-drawn bars from a manufacturer, which contained from 0.4 to 0.5 per cent carbon. These bars were cut in halves and one set was tested in its untreated condition, and the other set was annealed at 600 degrees, Cent., before testing. The results of these tests follow:

	Untreated bars.	Annealed bars.
Elongation, per cent.....	13.1	19.1
Reduction of area, per cent	41.6	47.7
Yield point, lb. per sq. in.	62,373	61,517
Ultimate strength, lb. per sq. in.	86,973	83,161

These tests show an increase in elongation of 6 per cent and 6.1 per cent in reduction of area. The yield point and the ultimate strength, however, both declined, the former 856 and the latter, 3,812 pounds.

Chilled Iron

E. B. Tilt, engineer of tests of the Canadian Pacific railway Angus shops, presented a paper entitled "Chilled Cast Iron as Employed in Car Wheels". The author expressed the opinion that the service results obtained depend on the final composition of the metal, and upon the care of manufacture and inspection, rather than upon the kind of iron which is used; also, that in wheel iron the total carbon should be about 3.40 to 3.60 per cent, rather than about 4 per cent, as with many white irons.

In discussing Mr. Tilt's paper, Thomas D. West asserted that uneven depth of the chill in a wheel is responsible for the majority of failures. He quoted as follows from a letter from the late Charles B. Dudley, former president of the society, who referred to the experience at the Pennsylvania railroad's Altoona shops: "The foreman of our foundry says that, based on his observation of broken car wheels for about 25 to 30 years, at least 70 per cent of them show from ⅛ to ¼ inch variation in the depth of the white iron at different parts of the tread." Joseph E. Johnson Jr. stated that the quality of car wheels depends absolutely on the grade of the iron used; that the capacity for service of a wheel depends largely on the analysis and grain of the iron that goes into it. As an illustration, he said that one western railroad, which uses high grade iron, paying as high as $40 a ton for it, turns out wheels which have an average mileage of from 80,000 to 90,000. This, he said, compares with 30,000 to 40,000, the average mileage. Ira B. Lesh differed from Mr. Johnson on this point, claiming that as good results can be obtained with iron costing $14 a ton as with iron costing $40 a ton. The quality of the wheel, he said, depends on the care expended in supervising the various steps in the manufacture. It is of utmost importance, he said, to pour at the right temperature, open the mold at the right time, and anneal at the proper temperature.

Among the valuable papers submit-

ted at this meeting was one by J. A. Mathews, general manager of the Holcomb Steel Co., on "Magnetic Habits of Alloy Steels". The author suggested a new magnetic unit of magnetic hardness, Br/Hc; that is, he employed the ratio between residual density and coercive force to indicate magnetic hardness. He admitted that no definite laws have been found which determine the relationship between magnetic and physical characteristics but contended there are very striking similarities between magnetic and physical behavior. The results of his tests, said Mr. Mathews, showed that in hardened alloy steels the magnetic properties vary with the cross-section; in some cases, the magnetic hardness increases as the section increases while in other cases the reverse is true. In some alloy steels either condition may be had, depending upon the manner of quenching. Mr. Mathews stated that many alloy steels give lower induction, lower residual density and higher coercive force when quenched in oil than when quenched in water, the corresponding physical hardness test showing that the water quenching confers the greater hardness. In referring to the drawing of temper of hardened alloy steels, the author stated that for equal drawing temperatures the magnetic properties of oil-hardened pieces are most affected, while as to the physical hardness the water-hardened pieces are affected to the greater degree.

In discussing Mr. Mathew's paper, C. W. Burrows admitted that every thermal change carries with it a corresponding magnetic change, but the relations, he said, are rather complicated, and the whole nature of any particular steel cannot be determined by its magnetic characteristics. Since only one set of physical and chemical characteristics can be attended by a particular set of magnetic characteristics, Mr. Burrows believed good results might be obtained by employing the smallest possible number of magnetic characteristics to denote the physical and chemical characteristics desired.

S. V. Hunnings submitted a paper describing a new vibratory testing machine which he designed with a view to securing a machine that would hold all specimens absolutely rigid. The machine is capable of making rotative and reciprocating vibratory tests, as well as tension tests, and Mr. Hunnings dwelt at considerable length on the character of the results secured by its use.

Failed Axle

"A Failed Axle: Study of an Internal Transverse Fissure," was the subject of an exceedingly interesting paper by Robert Job, which is published elsewhere in this issue.

In discussing Mr. Job's paper, William Campbell stated that internal transverse fissures of the type described by the author are due always to one of two causes: Difference in the structure of the steel forming the interior and exterior of the axle, or a rough fracture due to improper heat treatment. Prof. Henry M. Howe stated there are two stages in the manufacture of an axle when the interior structure has no ductility. One of these is when the axle is passing into a form of solidity and the other when the ingot is charged cold into a hot furnace. In either case, Prof. Howe said, the exterior contracts or expands so much more rapidly than the interior that cracks are liable to occur in the interior. He emphasized the importance of timing the heating and cooling stages so as to enable the interior of the axle to expand and contract uniformly with the exterior.

Preservative Coatings for Structural Materials

The report of Committee D-1 on "Preservative Coatings for Structural Materials", contained sub-committee reports on the inspection of panels on the Havre de Grace bridge, coated steel plates at Atlantic City and an inspection of the white paint test fence at Washington, D. C. The test of the panels on the Pennsylvania railroad bridge at Havre de Grace, Md., has been under way for practically eight years, and the limit of the value of these tests has been practically reached. The condition of a considerable number of these paints indicates that with proper care in preparing metal surfaces and proper supervision of the application of the paints, good protection can be assured for a much longer time than is ordinarily considered the life of the general run of preservative materials.

Standard Methods of Tests

Committee E-1, of which Gaetano Lanza is chairman, presented methods for making Brinell hardness tests of metals; an addition to the present methods for tension tests giving the proper dimensions of tension test specimens for metal ¼ inch or under in thickness; changes in the present standard methods for tension tests, regarding the manner of using extensometers when determining the modulus of elasticity, the proportional limit, or the elastic limit. Changes in the present standard methods for tension and compressive tests, defining correctly proportional limit, elastic limit, and yield point, and correcting those portions of the methods which involve a wrong use of these terms.

Recommended Practice for Heat Treating Case-Hardened Carbon Steel

It is recommended that the following treatments be applied to case-hardened carbon steel objects according to requirements:

1.—When hardness of case only is desired and lack of toughness or even brittleness unimportant, the carburized objects may be quenched from the carburizing temperature, as for instance, by emptying the contents of the boxes in cold water or in oil. Both the core and the case are then coarsely crystallin.

2.—In order to reduce the hardening stresses and to decrease the danger of distortion and cracking in the quenching bath, the objects may be removed from the box and allowed to cool before quenching to a temperature slightly exceeding the critical range of the case, namely, 800 to 825 degrees Cent. Both the core and case remain coarsely crystallin.

3.—To refine the case and increase its toughness, the carburized objects should be allowed to cool slowly in the carburizing box within the furnace or outside to 650 degrees Cent., or below, and should then be reheated to a temperature slightly exceeding the lower critical point of the case (in the majority of instances a temperature varying in accordance with the carbon content and thickness of the case between 775 and 825 degrees Cent., will be suitable), and quenched in water, or, for greater toughness but less hardness, in oil. The objects should be removed from the quenching bath before their temperature has fallen below 100 degrees Cent. This treatment is more especially to be recommended when the carburizing temperature has not exceeded 900 degrees Cent. It refines the case but not the core.

4.—To refine both the core and the case and to increase their toughness, the objects should be allowed to cool slowly from the carburizing temperature to 650 degrees Cent. or below and should then be (*a*) reheated to a temperature exceeding the critical point of the core, which will generally be from 900 to 950 degrees Cent., followed by quenching in water or in oil; and (*b*) before they have cooled below 100 degrees Cent.,[1] they should be reheated to a temperature slightly exceeding the lower critical point of the case (in the majority of instances a temperature varying in accordance with the carbon content

[1] Adopted at the Atlantic City meeting of the American Society for Testing Materials and referred to the members for letter ballot.

and thickness of the case between 775 and 825 degrees Cent. will be suitable), and again quenched in water or oil.

5.—In order to reduce the hardening stresses created by quenching, the objects, as a final treatment, may be tempered by re-heating them to a temperature not exceeding 200 degrees Cent.

[1]The objects should be removed from the quenching bath before they have cooled below 100 degrees Cent., in order to lessen the danger of cracking, and they should be placed in the reheating furnace while still at a temperature of at least 100 degrees Cent., likewise to lessen the danger of cracking, it being inadvisable (*a*) to allow steel to cool completely in the quenching bath and (*b*) to place hardened steel in a hot furnace. Obviously, if the furnace is cold the hardened steel may likewise be cold when placed in it for re-heating.

How Steel Castings Should Be Annealed

1.—The castings should preferably be sufficiently cleaned of adhering sand before annealing to ensure thorough and uniform heating.

2.—The castings should be heated slowly and uniformly to temperatures varying with the carbon content of the steel, approximately as follows:

Carbon, per cent.	Temperature, deg., Cent.
Up to 0.16	925
0.16 to 0.34	875
0.35 to 0.54	850
0.55 to 0.79	830

Nothing in these recommendations shall operate against the temperatures aimed at being 50 and, in special cases, 100 degrees Cent. higher than those given in the table, when necessary to attain the desired result.

3.—The castings should be kept at the maximum temperature a sufficient length of time to ensure the refining of the grain. In general, the heavier the sections of the casting, the longer must be the time of exposure to the maximum temperature.

4.—(*a*) The castings should be cooled slowly and uniformly in the furnace, when it is desired that the steel shall possess the maximum softness.

(*b*) The castings may be cooled at an accelerated rate, when it is desired that the steel possess rather higher tensile strength and elastic limit than can be procured by very slow cooling. This cooling must be so conducted as to leave the steel reasonably free from cooling stresses.

The manner of carrying out this accelerated cooling should be such as will attain the desired result. For instance, the castings may be withdrawn from the furnace and buried in a bed of material that is a poor conductor of heat; or the annealing furnace may be so thrown open that it will cool more rapidly than if left closed. Should the castings be of such uneven section that they cool at unequal rates at various points when the furnace is opened, especially if the carbon of the steel is high, the furnace should be closed after the castings have become black, and their further cooling so retarded that the stresses set up by the unequal rates of cooling are relieved.

Adopted at the Atlantic City meeting of the American Society for Testing Materials and referred to the members for letter ballot.

Specifications for Steel Forgings

1.—(*a*) These specifications cover the various classes of carbon steel and alloy steel forgings now commonly used and not covered by other existing specifications of the American Society for Testing Materials.

(*b*) The purposes for which these classes are frequently used are as follows:

Class A, for forgings which may be welded or case hardened.

Class B, for mild steel forgings for structural purposes, for minor ship fittings, etc.

Class C, for mild steel forgings for structural purposes, for ships, etc.

Classes D, E, F, G, H and I, for various machinery forgings, choice depending upon design and upon the stresses and services to be imposed.

Manufacture.

2.—The steel may be made by the open-hearth or any other process approved by the purchaser.

3.—A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

4.—The manufacturer and the purchaser shall agree upon forgings on which a prolongation for test purposes shall be provided.

5.—If boring is specified, the diameter of the hole shall be at least 20 per cent of the maximum outside diameter or thickness of the forging, exclusive of collars and flanges.

6.—Heat treatment, if required, shall consist of either annealing or quenching and tempering, as specified.

(*a*) For annealing, the forgings shall be allowed to become cold after forging. They shall then be uniformly reheated to the proper temperature to refine the grain (a group thus reheated being known as an "annealing charge"), and allowed to cool uniformly.

(*b*) For quenching and tempering, the forgings shall be allowed to become cold after forging. They shall then be uniformly reheated to the proper temperature to refine the grain (a group thus reheated being known as a "quenching charge"), and quenched in some medium under substantially uniform conditions for each quenching charge. Finally, they shall be uniformly reheated to the proper temperature for tempering or "drawing back" (a group thus reheated being known as

Adopted at the Atlantic City meeting of the American Society for Testing Materials and referred to the members for letter ballot.

Table I.

TENSILE PROPERTIES (CLASSES A TO F, INCLUSIVE).

For Forgings Whose Maximum Outside Diameter or Over-all Thickness is Not Over 20 Inches.

Class.	Size. Outside diameter or over-all thickness.	Tensile strength, min. (except Class A), lb. per sq. in.	Yield Point, min., lb. per sq. in.	Elongation in 2 in., min., per cent.		Reduction of Area, min., per cent.	
				Inverse Ratio.	Not under	Inverse Ratio.	Not under
A Untreated	All sizes	47,000 to 60,000	0.5 tens. str.	1,500,000 / Tens. str.	..	2,500,000 / Tens. str.	..
B Untreated	Not over 12 in.	60,000	0.5 tens. str.	Tens. str. 1,550,000 / Tens. str.	22	Tens. str. 2,400,000 / Tens. str.	35
	Over 12 to 20 in., inclusive	60,000	0.5 tens. str.	1,480,000 / Tens. str.	21	2,220,000 / Tens. str.	32
C Annealed	Not over 12 in..	60,000	0.5 tens. str.	1,700,000 / Tens. str.	25	2,700,000 / Tens. str.	38
	Over 12 to 20 in., inclusive	60,000	0.5 tens. str.	1,600,000 / Tens. str.	24	2,520,000 / Tens. str.	36
D Untreated	Not over 8 in..	75,000	0.5 tens. str.	1,600,000 / Tens. str.	18	2,200,000 / Tens. str.	24
	Over 8 to 12 in., inclusive	75,000	0.5 tens. str.	1,500,000 / Tens. str.	17	2,000,000 / Tens. str.	22
	Over 12 to 20 in., inclusive	75,000	0.5 tens. str.	1,400,000 / Tens. str.	16	1,800,000 / Tens. str.	20
E Annealed	Not over 8 in...	75,000	0.5 tens. str.	1,800,000 / Tens. str.	20	2,800,000 / Tens. str.	33
	Over 8 to 12 in., inclusive	75,000	0.5 tens. str.	1,725,000 / Tens. str.	19	2,640,000 / Tens. str.	31
	Over 12 to 20 in., inclusive	75,000	0.5 tens. str.	1,650,000 / Tens. str.	18	2,400,000 / Tens. str.	29
F Annealed	Not over 8 in...	80,000	0.5 tens. str.	1,800,000 / Tens. str.	20	2,800,000 / Tens. str.	32
	Over 8 to 12 in., inclusive	80,000	0.5 tens. str.	1,725,000 / Tens. str.	19	2,640,000 / Tens. str.	30
	Over 12 to 20 in., inclusive	80,000	0.5 tens. str.	1,650,000 / Tens. str.	18	2,400,000 / Tens. str.	28

a "tempering charge"), and allowed to cool uniformly.

Chemical Properties and Tests.

7.—The steel shall conform to the following requirements as to chemical composition:

Elements considered.	Class A.	Classes B, C, D, E, F, G.	Classes H, I.
Manganese, per cent.....	0.30–0.55	0.40–0.80	0.40–0.80
Phosphorus, per cent.....	Not over 0.05	Not over 0.05	Not over 0.04
Sulphur, per cent.....	Not over 0.05	Not over 0.05	Not over 0.05
Nickel, per cent.....	.....	.....	Not under 3.00

8.—An analysis to determine the percentages of carbon and the elements specified in Section 7 shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 7.

9.—Analyses may be made by the purchaser from a forging representing each melt, which shall conform to the requirements specified in Section 7. Drillings for analysis may be taken from the forging or from a full size prolongation of the same at any point midway between the center and surface of solid forgings, and at any point midway between the inner and outer surfaces of the wall of bored forgings; or turnings may be taken from a test specimen.

Physical Properties and Tests.

10.—(*a*) The forgings shall conform to the requirements as to tensile properties specified in Tables I and II.

(*b*) The classification by size of the forging shall be determined by the specified diameter or thickness which governs the size of the prolongation from which the test specimen is taken.

(*c*) The yield point shall be determined by the drop of the beam of the testing machine.

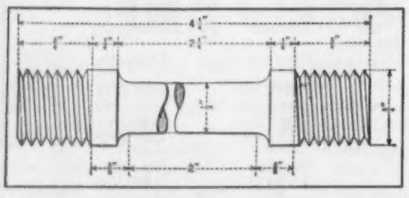
(*d*) The elastic limit shall be determined by means of an extensometer.

(*e*) Tests of forgings shall be made only after final treatment.

11.—(*a*) Tension test specimens shall be taken from a full size prolongation of any forging. For forgings with large ends or collars the prolongation may be of the same cross-section as that of the forging back of the large end or collar. Specimens may be taken from the forging itself with a hollow drill, if approved by the purchaser.

(*b*) The axis of the specimen shall be located at any point midway between the center and surface of solid forgings, and at any point midway between the inner and outer surfaces of the wall of bored forgings, and shall be parallel to the axis of the forging in the direction in which the metal is most drawn out.

(*c*) Test specimens shall be of the form and dimensions shown in the following illustration.



12.—Unless otherwise specified by the purchaser, tests shall be made as follows:

(*a*) For untreated forgings, one tension test shall be made from each melt.

(*b*) For annealed forgings, one tension test shall be made from each annealing charge. If more than one melt is represented in an annealing charge, one tension test shall be made from each melt.

(*c*) For quenched and tempered forgings, one tension test shall be made from each tempering charge. If more than one quenching charge is represented in a tempering charge, one tension test shall be made from each quenching charge. If more than one melt is represented in a quenching charge, one tension test shall be made from each melt.

(*d*) If more than one class of forgings by size is represented in any lot, one tension test from a forging of each class by size shall be made as specified in Sections 10 and 11.

(*e*) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(*f*) If the percentage of elongation of any tension test specimen is less than that specified in Section 10 (*a*) and any part of the fracture is more than ¾ in. from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

13.—If the results of the physical tests of any test lot do not conform to the requirements specified, the manufacturer may retreat such lot one or more times and retests shall be made as specified in Section 12.

Workmanship and Finish.

14.—The forgings shall conform to the sizes and shapes specified by the purchaser. When centered, 60-deg. centers with clearance drilled for points shall be used.

15.—The forgings shall be free from injurious defects and shall have a workmanlike finish.

Marking.

16.—Identification marks shall be legibly stamped on each forging and on each test specimen. The purchaser shall indicate the location of such identification marks.

Inspection and Rejection.

17.—(*a*) The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser

Table II.

TENSILE PROPERTIES (CLASSES G, H AND I).

Class.	Size.	Tensile Strength, min., lb. per sq. in.	Elastic Limit, min., lb. per sq. in.	Elongation in 2 in., min., per cent. Inverse Ratio.	Elongation in 2 in., min., per cent. Not under	Reduction of Area, min., per cent. Inverse Ratio.	Reduction of Area, min., per cent. Not under
For Forgings whose Maximum Outside Diameter or Thickness is not over 10 inches when Solid, and not over 20 Inches when bored.							
G Quenched and tempered.	Up to 4 in. in outside diameter of thickness, 2-in. max. wall.....	90,000	55,000	2,100,000 / Tens. str.	20.5	4,000,000 / Tens. str.	39
	Over 4 to 7 in. in outside diameter or thickness, 3½-in. max. wall.....	85,000	50,000	2,000,000 / Tens. str.	20.5	3,800,000 / Tens. str.	39
	Over 7 to 10 in. in outside diameter or thickness, 5-in. max. wall	85,000	50,000	1,900,000 / Tens. str.	19.5	3,600,000 / Tens. str.	37
	Outside diameter or thickness not over 20 in., 5 to 8-in. wall.....	82,500	48,000	1,800,000 / Tens. str.	19	3,400,000 / Tens. str.	36
For Forgings whose Maximum Outside Diameter or Over-all Thickness is not over 20 Inches.							
H Nickel Steel, annealed.	Outside diameter or over-all thickness not over 12 in.....	80,000	50,000	2,000,000 / Tens. str.	22	3,600,000 / Tens. str.	40
	Outside diameter or over-all thickness over 12 to 20 in., inclusive	80,000	50,000	1,900,000 / Tens. str.	21	3,400,000 / Tens. str.	38
For Forgings whose Maximum Outside Diameter or Thickness is not over 10 Inches when Solid, and not over 20 Inches when Bored.							
I Nickel Steel, quenched and tempered..	Up to 4 in. in outside diameter or thickness, 2-in. max. wall	100,000	70,000	2,200,000 / Tens. str.	20	4,500,000 / Tens. str.	41
	Over 4 to 7 in. in outside diameter or thickness, 3½-in. max. wall	100,000	65,000	2,100,000 / Tens. str.	20	4,300,000 / Tens. str.	41
	Over 7 to 10 in. in outside diameter or thickness, 5-in. max. wall	90,000	60,000	2,000,000 / Tens. str.	20	4,100,000 / Tens. str.	41
	Outside diameter or thickness not over 20 in., 5 to 8-in. wall	85,000	55,000	1,900,000 / Tens. str.	20	3,900,000 / Tens. str.	41

is being performed, to all parts of the manufacturer's works which concern the manufacture of the forgings ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the forgings are being furnished in accordance with these specifications. Tests and inspection at the place of manufacture shall be made prior to shipment.

(*b*) The purchaser may make the tests to govern the acceptance or rejection of the forgings in his own laboratory or elsewhere. Such tests, however, shall be made at the expense of the purchaser.

(*c*) Tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

18. — (*a*) Unless otherwise specified, any rejection based on tests made in accordance with Section 17 (*b*) shall be reported within five working days from the receipt of samples.

(*b*) Forgings which show injurious defects while being finished by the purchaser will be rejected, and the manufacturer shall be notified.

19.—Samples tested in accordance with Section 17 (*b*), which represent rejected forgings, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Specifications for Car Steel

1.—These specifications apply to shapes, plates and bars over ⅛ inch in thickness.

Manufacture.

2.—The steel shall be made by the open-hearth process.

Chemical Properties and Tests.

3.—The steel shall conform to the following requirements as to chemical composition:

	Structural steel, and plates for cold flanging, not over, per cent.	Rivet steel, not over, per cent.
Phosphorus, acid ..	0.06	0.04
Phosphorus, basic...	0.04	0.04
Sulphur	0.05	0.045

4.—An analysis to determine the percentages of carbon, manganese, phosphorus and sulphur shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 3.

5.—Analyses may be made by the purchaser from finished material representing each melt, in which case an excess of 25 per cent above the requirements specified in Section 3 shall be allowed.

Physical Properties and Tests.

6.—(*a*) The material shall conform to the following requirements as to tensile properties:

Properties considered.	Structural steel.	Rivets, and plates for cold flanging.
Tensile strength, pounds per square inch.....	50,000–65,000	48,000–58,000
Yield point, minimum, pounds per square inch.....	0.5 tens. str.	0.5 tens. str.
Elongation in 8 inches, minimum, per cent[1].....	1,500,000 / Tens. str.	1,500,000 / Tens. str.

[1]See Section 7.

(*b*) The yield point shall be determined by the drop of the beam of the testing machine.

7.—(*a*) For material over ¾ inch in thickness, a deduction of 1 from the percentage of elongation specified in Section 6 (*a*) shall be made for each increase of ⅛ inch in thickness above ¾ inch, to a minimum of 18 per cent.

(*b*) For material under ⅜ inch in thickness, a deduction of 2.5 from the percentage of elongation in 8 inch specified in Section 6 (*a*) shall be made for each decrease of ⅛ inch in thickness below ⅜ inch.

8.—(*a*) The test specimen for structural steel shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows: For material ¾ inch or under in thickness, flat on itself; for material over ¾ inch to and including 1¼ inches in thickness, around a pin the diameter of which is equal to the thickness of the specimen; and for material over 1¼ inches in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen.

(*b*) The test specimen for rivet steel and plates for cold flanging shall bend cold through 180 degrees flat on itself without cracking on the outside of the bent portion.

Adopted at the Atlantic City meeting of the American Society for Testing Materials and referred to the members for letter ballot.

9.—(*a*) Tension and bend test specimens shall be taken from the finished rolled material.

(*b*) Tension and bend test specimens, except as specified in Paragraph (*c*), shall be of the full thickness of material as rolled; and may be machined to the form and dimensions shown in the accompanying illustration, or with both edges parallel.

(*c*) Tension and bend test specimens for plates and bars over 1½ inches in thickness or diameter may be machined to a thickness or diameter of at least ¾ inch for a length of at least 9 inches.

10.—(*a*) One tension and one bend test shall be made from each melt; except that if material from one melt differs ⅜ inch or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material rolled. Shapes less than 1 square inch in section, and bars, except rivet rods, less than ½ square inch in section, need not be subjected to a tension test.

Thickness ordered, in.	Nominal weight, lb. per sq. ft.	Allowable excess (expressed as percentage of nominal weight). For width of plate as follows: Under 50 in.	50 to 70 in., excl.	70 in. or over.	Under 75 in.	75 to 100 in., excl.	100 to 115 in., excl.	115 in. or over.
⅛ to 5/16	5.10 to 6.37	10	15	20	..	..	..	..
5/16 to 7/16	6.37 to 7.65	8.5	12.5	17	..	..	..	..
7/16 to ¼	7.65 to 10.20	7	10	15	..	..	..	..
¼	10.20	..	..	..	10	14	18	..
5/16	12.75	..	..	..	8	12	16	..
3/8	15.30	..	..	..	7	10	13	17
7/16	17.85	..	..	..	6	8	10	13
½	20.40	..	..	..	5	7	9	12
9/16	22.95	..	..	..	4.5	6.5	8.5	11
5/8	25.50	..	..	..	4	6	8	10
over 5/8	.....	..	..	..	3.5	5	6.5	9

(*b*) Tension and bend test specimens for rivet steel and plates for cold flanging shall be taken from the finished rolled material.

(*c*) Tension and bend test specimens for plates and bars over 1½ inches in thickness or diameter may be machined to a thickness or diameter of at least ¾ inch for a length of at least 9 inches.

(*d*) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(*e*) If the percentage of elongation of any tension test specimen is less than that specified in Section 6 (*a*) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

Permissible Variations in Weight and Gage.

11.—The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent from that specified; except in the case of sheared plates, which shall be covered by the following permissible variations to apply to single plates:

(*a*) When Ordered to Weight.—For plates 12½ pounds per square foot or over:

Under 100 inches in width, 2.5 per cent above or below the specified weight.

100 inches in width or over, 5 per cent above or below the specified weight.

For plates under 12½ pounds per square foot:

Under 75 inches in width, 2.5 per cent above or below the specified weight.

75 to 100 inches, exclusive, in width, 5 per cent above or 3 per cent below the specified weight.

100 inches in width or over, 10 per cent above or 3 per cent below the specified weight.

(*b*) **When Ordered to Gage.**—The thickness of each plate shall not vary more than 0.01 inch under that ordered.

An excess over the nominal weight corresponding to the dimensions on the order shall be allowed for each plate, if not more than that shown in the following table, one cubic inch of rolled steel being assumed to weigh 0.2833 pound:

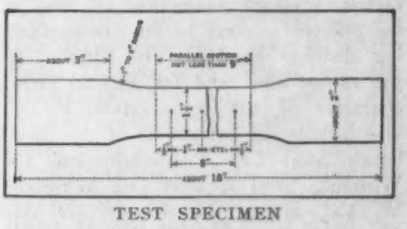
12.—The finished material shall be free from injurious defects and shall have a workmanlike finish.

Marking.

13.—The name or brand of the manufacturer and the melt number shall be legibly rolled or stamped on all finished material, except that rivet bars and other small sections shall, when loaded for shipment, be properly separated and marked for identification. The melt number shall be legibly marked, by stamping if practicable, on each test specimen.

Inspection and Rejection.

14.—The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is be-



TEST SPECIMEN

ing performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecesily with the operation of the works.

15.—(*a*) Unless otherwise specified, any rejection based on tests made in accordance with Section 5 shall be reported within five

working days from the receipt of samples.

(b) Material which shows injurious defects subsequent to its acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

16.—Samples tested in accordance with Section 5, which represent rejected material, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Specifications for Cold-Drawn Steel

Bessemer Automatic Screw Stock.

1.—The material desired under these specifications is a free-cutting steel of any specified section suitable for high speed screw machine work, leaving a smooth finish after machining.

2.—The steel shall be made by the Bessemer process, and shall be cold rolled or cold drawn or turned to size.

3.—The steel shall conform to the following requirements as to chemical composition:

	Per cent.
Carbon	0.08 –0.16
Manganese	0.60 –0.80
Phosphorus	0.09 –0.13
Sulphur	0.075–0.15

4.—Samples for analysis shall be taken by machining off the entire cross-section of the bar, or by drilling parallel to the axis of the bar at any point midway between the center and surface with a drill not under ½ nor over ¾ inch in diameter. Samples shall be clean, free from oil, uniformly fine and well mixed.

Permissible Variations in Dimensions.

5.—The variation from the specified diameter, or distance between parallel faces, and the allowable eccentricity shall not exceed the following limits:

PERMISSIBLE VARIATIONS

Diameter.	Over-size.	Under-size.	Eccentricity.
Up to and including 0.3 in.	0	1 per cent of diameter	0.5 per cent of diameter
Over 0.3 in. to and including 1 in.	0	0.003 in.	0.0015 in.
Over 1 in. to and including 2½ in.	0	0.004 in.	0.0020 in.
Over 2½ in.	0	0.005 in.	0.0025 in.

6.—The material shall be free from injurious defects and shall have a bright smooth surface.

7.—The manufacturer shall afford the inspector representing the purchaser, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications.

8.—Material which fails to conform to the above specifications will be rejected, and the manufacturer shall be notified.

Adopted at the Atlantic City meeting of the American Society for Testing Materials and referred to the members for letter ballot.

Will Dig Deep

To Get Facts About Ore Carrying for the Commission

Washington, July 7.—By reason of the determination of the Interstate Commerce Commission to amalgamate the case of independent ore consumers of the Mahoning valley of Ohio and the Shenango valley of Pennsylvania with the general investigation into the ore rate structure of Ohio, West Virginia and western Pennsylvania that case, which has long been awaiting decision, is still further deferred. The case involved a protest against the rate of 56 cents on direct ore from Lake Erie ports to the furnaces of the two valleys, and was begun in 1911.

Hearing of the issues arising in the investigation, the most far reaching of the kind ever undertaken by the commission, is expected to begin the latter part of September or early in October. It is probable that most of the sessions will take place in Washington, although some may be held at the different centers of the ore consuming districts involved. In addition to the valleys case, and the general broad character of the investigation, it will also include the complaints of the Pittsburgh Steel Co., Pittsburgh, and the Wheeling Steel & Iron Co., Wheeling, W. Va., against the 88 cent ore rate from Lake Erie docks to Pittsburgh and Wheeling. The investigation has already been started.

Increased interest in the matter has been added through the action of the Jones & Laughlin Steel Co., Pittsburgh. It has determined upon a unique way of approaching the big subject at hand, calling for a most thorough survey of the entire situation

With this object in view, the Jones & Laughlin company has engaged the service of Jean Paul Muller of this city, an expert accountant, who will go over the entire ore consuming field affected and gather a great mass of facts, covering all points involved. Preliminary work of that nature has been started by him and will be continued until his investigation is completed. The terminal situation at every point, with regard to costs of the services, the layout of the terminals, their locations with respect to the different furnaces and the furnace capacities, along with related material, will be given close attention. Photos, to be submitted as exhibits, will be taken of the terminals and furnaces and steel plants generally.

This work is being preferred for the purpose of giving the commission the advantage of every possible fact. Decision to take up this great task was partly prompted, it is said, as a result of the commission's finding in the Industrial Railways case, owners of the steel plant lines involved in that proceeding contending that the action of the commission was based upon incomplete information.

The plant of the Richardson & Boynton Co., Dover, N. J., manufacturers of stoves and ranges, was destroyed by fire recently involving a loss estimated at $500,000. The fire is believed to have been of incendiary origin. The plant will be rebuilt immediately and work to that end has been started.

The Bryce Heating & Ventilating Co., of Toledo, O., is the low bidder on the heating and ventilating equipment for the new Newman street school, Mansfield, O., at its bid of about $6,500.

Sign Scale

Sheet Manufacturers Agree to Last Year's Scale

A number of important sheet manufacturers of the middle west signed the wage scale of the Amalgamated Association of Iron, Steel and Tin Workers July 3 after wrestling with the problem all day at the Fort Pitt hotel, Pittsburgh.

The wage scale agreed upon finally was last year's scale. Considerable argument took place over footnotes which had to do with practical mill working. But at no time since the failure of the Atlantic City conference several weeks ago did the disagreement appear serious.

The manufacturers which have now agreed to accept the 1913-14 sheet mill wage scale of the Amalgamated Association for the year 1914-15 are the following: Carnahan Tin Plate & Sheet Co., Canton, O.; Newport Rolling Mill Co., Newport, Ky.; Follansbee Bros. Co., Follansbee, W. Va.; Youngstown Iron & Steel Co., Youngstown; American Rolling Mill Co. for its Middletown O., works; Deforest Sheet & Tin Plate Co., Niles, O.; Trumbull Steel Co., Warren, O.; Brier Hill Steel Co., Youngstown, O., for its Niles works; Whitaker-Glessner Co., Wheeling; National Stamping & Enameling Co., St. Louis, for its Granite City works.

It is expected most of these works, which have not closed because of necessary repairs, will resume operating this week.

The Huber Mfg. Co., Marion, O., suffered a loss of about $10,000 by a fire in its foundry and core room, recently.

Ore Shipments

In June Show Decline—Season's Total Low

Ore shipments during June were 5,502,367 gross tons as against 7,974,444 gross tons for June, 1913, a decrease of 2,472,077 tons. Up to July 1, 9,624,116 tons have been moved as against 16,125,042 gross tons for the corresponding period last year, a decrease of 6,500,926 tons. The movement is, therefore, 40 per cent less than it was for the same period last year. The movement to June 1, however, was more than 50 per cent less than that of last year, so that the trade is gaining a little headway. No material improvement is expected during July, but it looks now as though the low point of depression had been reached and that one may expect a constantly increasing movement during the balance of the year. The outlook is somewhat more hopeful than it was a month ago and a total movement of 37,000,000 tons for the season is now predicted. Following are the ore shipments during June and up to July 1, with corresponding data for last year:

Port.	June, 1913.	June, 1914.
Escanaba	845,414	580,103
Marquette	532,736	262,075
Ashland	774,761	541,315
Superior	2,377,078	1,997,895
Duluth	1,895,728	1,045,786
Two Harbors	1,548,727	1,075,193
	7,974,444	5,502,367
1914 decrease		2,472,077

Port.	To July 1, 1913.	To July 1, 1914.
Escanaba	1,800,601	1,076,020
Marquette	1,059,776	383,948
Ashland	1,509,702	883,081
Superior	4,677,349	3,733,502
Duluth	3,995,948	1,779,876
Two Harbors	3,081,666	1,767,689
	16,125,042	9,624,116
1914 decrease		6,500,926

Cuyuna Range News Notes

Brainerd, Minn., July 6.—Surveyors at Crosby have established the location of the main shaft to be put down by John A. Savage and associates, whose company, the Merrimac Mining Co., has taken over the Jamieson and Peacock holdings, and the 40 owned by John G. Williams and A. M. Chisholm, of Duluth, and B. Magoffin Jr., of Deerwood. Four hundred feet from the main shaft, on the forties leased, will be put down a temporary shaft to be used later as a timber shaft.

The Rowe pit mine of the Pittsburgh Steel Ore Co., at Riverton, is operating its hydraulic equipment. The big steam shovel is in ore and shipping will soon commence. The Wilcox mine of the Canadian-Cuyuna Ore Co. is down 84 feet with its shaft. Ledge will be reached about July 1.

Test pitting carried on by the June Lake Iron Co. at its holdings in section 9, township 46, range 29, has revealed a fine ore body. The company held to its lease because it believed that drilling alone would not reveal the true richness of the property, as was shown in the operations at the Rowe mine, where the drill records were exceeded when mining began. The June Lake Iron Co. people paid royalties several years and today their persistence has been rewarded. Where the drills showed 40 to 50 per cent ore, the test pit samples have run from 55 to 60 per cent. In the company are many Superior people, including Gurdon Winsor, E. L. Johnson, W. E. Pickering, Mrs. A. D. S. Gillette, Clough Gates, Wm. H. Cruickshank, also Mrs. R. B. Dowse, of Duluth, and C. W. Potts, of Deerwood.

Shipping has commenced from the big stockpile of Armour No. 2 mine of the Rogers, Brown Ore Co., at Crosby and the Kennedy mine of the same company at Cuyuna will also soon start shipping from the stockpiles accumulated in the winter months.

The amalgamation of the Cuyuna-Mille Lacs and Cuyuna-Duluth mines and the Dunbar furnaces and other eastern interests has been completed, and the new company, the American Manganese Mfg. Co., is expected to start shipping heavily.

Near Crosby eastern capitalists operating under Supt. Savage's direction intend to open the Hans Anderson property. Mr. Savage was formerly with the Shenango Furnace Co.

In railway work, the Cuyuna Northern is laying rails on its extension from the Cuyuna-Mille Lacs mine to the Duluth-Brainerd mine. McCullough & Cheney, Minneapolis railway contractors, are putting in the grade of a line to connect the Northern Pacific with the Wilcox mine at Woodrow, the track starting at Loerch on the main line and extending south to the mine.

The International Smelting & Refining Co. has let contract to Riter-Conley Mfg. Co., Pittsburgh, for oil receiving tanks, oil units and oil storage tanks, converter air mains and miscellaneous plate work to be erected at Miami, Ariz., and involving 400 tons of material.

Average Prices

For Sales of Pig Iron in June Show Little Change

The average pig iron sales prices for June, as compiled by W. P. Snyder & Co., Pittsburgh, made the expected showing. The figures, $14 for Bessemer and $13 for basic, were right in line with the general market as indicated from time to time in THE IRON TRADE REVIEW. The steel-making grades of pig iron have not budged from the position which they took back in April, continuing it through May and June. Sales of these grades in the month just closed were few and the known transactions involving 1,000 tons or more of these irons could be counted upon the fingers of one hand.

The June average of Bessemer, $14 valley, showed a loss of $2.2375 as compared with the average realized prices in June last year. Basic showed a loss of $1.50 as compared with the basic average in June a year ago when it reached $14.50. For the past six months both grades showed little price movement. Bessemer began the year with an average of $14.035, got as high as $14.225 in February, declined to $14.1667 in March and dropped to $14 in April, where it since has remained. Basic began the year with an average of $12.325, advanced to $13.059 in February, declined to $13.041 in March and in April struck $13, which has remained its steady gait.

Pig Iron Celebration Held

Seventy-five years ago, on July 4, the first pig iron to be manufactured with anthracite coal in the United States was smelted at Catasauqua, Pa., and an Old Home Week was held in that city last week to commemorate this event. The celebration program consisted of parades, band concerts, fireworks displays and sports. The first furnace to use successfully anthracite coal or fuel was erected by David Thomas, a Welshman, at Catasauqua, in 1840. Mr. Thomas, who had had a successful career as an iron maker in Wales, was induced to come to this country and to establish the furnace by companies holding large tracts of coal land in the Lehigh valley. The original furnace was 42 feet high and 12 feet bosh and it was the first unit of what is today the Crane Iron Works, now a part of the Empire Steel & Iron Co. Mr. Thomas remained with the Crane Iron Works until 1852, when he turned over the management to his sons and established the Thomas Iron Co., at Hokendauqua, Pa., a short distance away.

TIPS FOR NEW BUSINESS

Equipment needs of the Iron and Steel works, Machine shops, Foundries and other Metal Working plants

In New York, the last week of June witnessed a considerable improvement in the amount of business booked by machinery sellers. As a month, June ranked higher in the amount of new business booked than May, with nearly all concerns. The first half of 1914, however, compares unfavorably with the first half of the preceding year. All concerns in the machinery trade in the metropolitan district report a great shrinkage in business; in general, the business booked during the first half of 1914 is about 60 per cent of the total bookings during the first half of 1913. Among the large purchasers last week was the Norfolk & Western, which bought 14 tools. The Seaboard Air Line bought a few small tools and this road and the Atlantic Coast Line have given intimations that they expect shortly to close on the large lists of machinery specifications which they have had before the trade for some time. The week was an especially good one for crane manufacturers. The largest buyer was the government, which closed for a large number of crane and some other machinery for the Puget Sound, Brooklyn, Norfolk and League Island navy yards. The major portion of this business was taken by Manning, Maxwell & Moore, Niles-Bement-Pond, Exeter Machine Works and Wickes Brothers. Manning, Maxwell & Moore took the contract for a 16 x 10 x 30-foot planer for League Island; this is the largest size planer made. A large manufacturer in Ansonia, Conn., placed an order for five good-sized cranes. Other crane business still is pending. A Newark foundry is in the market for two small cranes. The General Electric Co. has placed an order for $16,000 worth of equipment for its Erie foundry. The leading cast iron pipe maker is in the market for considerable machinery. There has been a marked improvement in demand from abroad; this demand is particularly active from France. On the whole, the machinery market in New York looks better than in a long time.

In Cincinnati, machine tool plants are closing down, some for mid-summer repairs and alterations, but others because of the lack of business on their books. In some cases, plants may remain closed for several months, or until they have accumulated enough orders to warrant reopening. A number of machine tool makers here have been barely operating for months, and the general opinion is that an improvement of business cannot be looked for until next fall. Lathes are the best in demand at the present time, but orders are mostly for single tools. Makers of special machinery are busy on old orders. Second-hand machinery is slow and unsatisfactory.

EASTERN STATES

ATHOL, MASS.—Union Twist Drill Co. has awarded E. J. Cross, city, the contract for a three-story brick factory addition and a one-story addition to the present building; estimated cost, $60,000.

BOSTON.—The Bowers Can Seal Co. has been incorporated; $600,000; by John P. Lazenby, E. T. Roche and N. A. Daniher.

INDIAN ORCHARD, MASS.—The Springfield Foundry Co. is building a modern concrete addition to its foundry on the Boston & Albany main line near Oak street station.

WORCESTER, MASS. — The Rockwood Sprinkler Co., 38 Harlow street, is erecting a 2-story brick addition.

BRIDGEPORT, CONN.—Premier Electrical Mfg. Co. has been incorporated; $50,000; by Walter E. French, Edward E. Forstrum, Fred A. North, Hoartio J. French, city.

DANBURY, CONN.—The Ball & Roller Bearing Co. has been incorporated; balls and roller bearings; $100,000; by Louis R. Heim, J. Henry Roth and William C. Barrett, city.

STRATFORD, CONN.—Bridegport Process Co. has been incorporated to case-harden metals; $50,000; by Sanford Stoddard, Ewen McLachlen and William J. Bartley, city.

ALBANY, N. Y.—The Albany Malleable Iron Co. has increased its capital stock from $150,000 to $350,000.

BUFFALO.—Department of public works will advertise bids in about two weeks for Abbot road bascule bridge over Buffalo river; contract involves 1,200 tons of steel.

EDWARDS, N. Y.—The zinc concentrating plant just completed by the Northern Ore Co. was badly damaged by fire June 26; loss, $200,000, part of this being covered by insurance; machinery was completely wrecked. The plant will be rebuilt as soon as the machinery can be duplicated.

GREENPORT, L. I.—The village council has a proposition from a Seattle firm, manufacturing oil-burning boilers. The concern desires to establish a $25,000 branch factory in the east, it asks only a site.

ALLENTOWN, PA.—Lehigh Bolt & Nut Co. has purchased a 4-acre site here and will erect a 100 x 287-foot mill.

ALTOONA, PA. — Pennsylvania railroad plans to erect an $80,000 spring annealing plant for its machine shops here.

BEAVER FALLS, PA.—Ingham Richardson Mfg. Co. has been incorporated; enameling signs and specialties; has increased its capital stock from $150,000 to $350,000.

HARRISBURG, PA.—Emerson-Brantingham Implement Co. has a permit to erect a 3-story, 141 x 196-foot warehouse.

PHILADELPHIA.—E. E. Brown & Co., Inc., has been incorporated; elevator and window weights; $50,000; by Clarence R. Brown, T. Harold Brown, Paxson Deet, W. G. Littleton, city, and A. A. Tanner, Waterbury, Conn.

POTTSTOWN, PA.—Pottstown Steel Co. has increased its capital stock from $5,000 to $50,000.

WAYNESBORO, PA. — Frick Co., manufacturer of engines, boilers, etc., has increased its capital stock from $1,125,000 to $1,500,000.

BALTIMORE.—Gandy Belt Co. will erect a $100,000 plant at 719-731 West Lombard street; Tufts Construction Co. has the contract.

CENTRAL STATES

BOWLING GREEN, O.—C. E. Steinbaugh, county auditor, will open bids July 27 for a 510-foot reinforced concrete arch bridge in Washington township.

CARTHAGE, O.—The Union Distilling Co. plans to erect a 57 x 58-foot boiler plant. Equipment includes 266-ton coal bunker, hydraulic ash lift, two 300-horsepower water tube boilers and provisions for a duplicate set.

DAYTON, O.—The Rubicon Tool & Mfg. Co. has been incorporated with a capital stock of $1,200 to manufacture metal specialties. Among the incorporators are E. J. P. Hill, C. O. Shaffer and H. P. Barck.

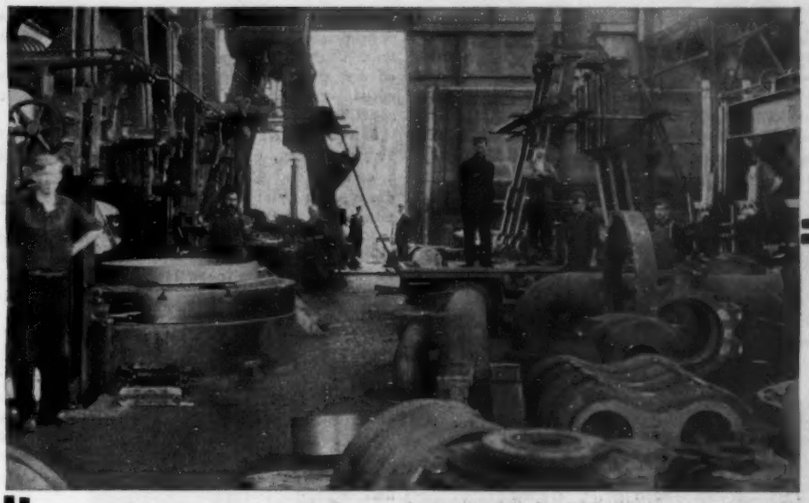
DENNISON, O.—Dennison Foundry & Machine Co. has been incorporated; $15,000; by Thomas Wright, E. E. Vanostran and Maurice Moody.

FRANKFORT, O.—Board of trustees will receive bids until noon, July 21 for water works system; plans on file with G. H. Schadel, clerk and with W. J. Sherman Co., engineer, 615 Nasby, Toledo.

LANCASTER, O.—Harry E. Davis, of Pittsburgh, representing the Midgley Tire & Rubber Co., will close the deal for buying a site on South Market street, including the old Ohio Flint Glass works, at $25,000. Remodeling work will be rushed and machinery selected.

MASSILLON, O.—Massillon Electric & Gas Co. has taken out a permit to erect a one-story brick power station on Erie street; cost, $20,000.

MILLERSBURG, O. — Citizens Light & Power Co. has been incorporated; $35,000; by



AYER & LORD INTERIOR — Always Easy on the Feet — WOOD BLOCKS

Pay just a little bit more the *first time*—it will *eliminate repairing expenses forever!*

A LIFETIME SERVICE!

There is more than just FLOORING behind AYER & LORD INTERIOR WOOD BLOCKS—there is SERVICE—service that will last for years and years, always adding a great, generous proportion to the efficiency of your whole shop.

ASK ANY OWNER!

Ayer & Lord Interior Wood Blocks

Form a Flooring of UNQUESTIONED SUPERIORITY

WHY

Because they make the BEST WORKING SURFACE procurable.
Because they represent the maximum of FLOORING ECONOMY.
Because they are ABSOLUTELY HEALTHFUL and the EASIEST on the workmen's feet and nerves.

Yes, Ayer & Lord Interior Wood Blocks form a flooring that has every desirable feature that a flooring *could* have—and they eliminate every fault.

Our little booklet "FLOORS" contains information that should be valuable to *you.*

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PHILADELPHIA, PA.
319 Perry Building

AYER & LORD INTERIOR — Always Easy on the Feet — WOOD BLOCKS

G. H. Billman, R. E. Dreyer, W. L. Koch.

MT. GILEAD, O.—Commissioners did not award the contract for the proposed 82-foot span bridge as planned, that size being considered inadequate. July 24 bids will be received on a larger structure.

SPRINGFIELD, O. — Robert C. Gotwald, architect, is drawing plans for a power plant at Wittenburg College.

SPRINGFIELD, O. — Springfield Railway Co. plans to increase its boiler capacity at the power house; bids in about two weeks.

TOLEDO, O.—The Ohio-Michigan Paper Co., whose plant burned last month, will have plans ready in a week for a three-story fireproof building to be completed Oct. 1; temporary quarters, 1210 Jackson street.

TROY, O.—County commissioners will receive bids until July 10 for a 60-foot span steel bridge with 5-foot sidewalks. L. P. Knoop, county engineer.

UPPER SANDUSKY, O. — Council has passed an ordinance to issue $52,000 bonds for a municipal lighting plant.

WAPAKONETA, O.—F. W. Langhorts, county auditor, will open bids July 18 for Verhorn bridge, Jackson township.

NEWELL, W. VA.—Newell Power & Water Co. has started excavations for the $35,000 addition to be erected; it will be 30 x 70 feet and will house machinery to double the capacity of both the pumping station and electric generating department.

LEXINGTON, KY.—Transylvania University will equip a heating and lighting plant; work on the building has just begun.

INDIANAPOLIS.—The Reinforced Box Machine Co has been incorporated to take over from Jason H. Greenstreet letters patent for manufacturing reinforced boxes; $600,000.

INDIANAPOLIS.—The Hercules Forge Co. recently was incorporated to manufacture drop forgings, automobile forgings and rolled steel wheels; $25,000; by J. H. Holliday Jr., president and treasurer; Alex. R. Holliday, vice president and Ward H. Dean, secretary. Alex. R. Holliday is secretary-treasurer of the National Concrete Co. and Mr. Dean is associated with the Hoosier Supply Co. Other incorporators were Anton Vonnegut, president and treasurer of the Vonnegut Machinery Co., and Owen M. Mothershead, manager of the Premier Sales Co.

CHICAGO.—Raphael W. Friedman, 110 So. Dearborn street, is preparing plans for an apartment building, three stories, 50 x 125 feet, to cost $40,000, containing structural steel and iron columns.

CHICAGO. — Automatic Screw Machine Products Co. has been incorporated to manufacture hardware; $16,000; by J. Arthur Johnson, Albert W. May, 111 West Monroe street, and Otto G. Griesbach.

CHICAGO.—Consolidated Rail & Iron Co. has been incorporated to deal in iron and steel scrap, machinery, etc.; $1,000; by Elizabeth Bradley, Maurice Gravitz and Samuel A. Miller, 155 North Clark street.

CHICAGO.—Paul F. P. Mueller, 179 West Monroe street, has the general contract for a factory building for the American Hotel Register Co., at 224 West Ontario street, six stories and basement, 87 x 100 feet, of brick and reinforced concrete, to cost $60,000.

GIFFORD, ILL.—Gifford Elevator Co. has been incorporated; $10,000; by George W. Herbert, Mack Cain, John Schulter, Eddie J. Sage and John Emkes.

PEORIA.—Progressive Engineering Co. has been incorporated to carry on a manufacturing and engineering business; $150,000; by Clayton Ewing, Geo. H. Beatty and Cagill V. Gerth.

CADILLAC, MICH.—Cadillac Machine Co. has a 60 x 80-foot foundry building under construction and will also erect a pattern shop and pattern storage room; the old foundry will be used for structural steel work.

JACKSON, MICH.—The J. C. Miller Block Machine Co. plans to enlarge its capacity and erect a foundry. An option has been obtained on an adjoining site.

BELOIT, WIS.—The Michigan Paper Co., Ipsilanti, Mich., has awarded the contract for furnishing and installing one of the largest paper machines ever constructed to the Beloit Iron Works, Beloit, Wis. It will have 81 drying rolls, 42 x 120 inches in size. The contract will keep the Beloit plant busy several months. It specializes in paper mill rolls and complete machinery.

GREEN BAY, WIS.—The Joseph F. Roth Foundry Co., capital stock $50,000, has been incorporated at Green Bay by Joseph F. and Christine Roth and L. D. Joseph to conduct a general foundry business.

KENOSHA, WIS. — Additions costing between $75,000 and $100,000 have been started by the Simmons Mfg. Co., manufacturer of metal beds.

MILWAUKEE, WIS.—The Prime Mfg. Co. has been organized by officers of the Prime Steel Co., Milwaukee, for the purpose of manufacturing railroad supplies. A. W. Prime, Orton L. Prime and H. G. Wild appear as incorporators. The capital stock is $2,500.

MILWAUKEE, WIS.—Herman J. Esser, architect, is completing plans for a $500,000 addition to the store of Gimbel Bros. in Milwaukee. Bids will be taken about July 15. The plans call for a steel and terra cotta building, three and four stories, 110 x 210 feet. William McLaren is general manager.

PLYMOUTH, WIS.—The addition to the Plymouth Foundry & Machine Co.'s plant is nearly completed and the company already considers enlarging the new building.

RICE LAKE, WIS.—The Automatic Trip Carrier Co., manufacturing stable and barn equipment, has increased its capital stock from $50,000 to $100,000 and will build a new factory at once.

ST. LOUIS.—The Pull-U-Out Mfg. Co. has been incorporated to manufacture geared pulleys and stakes; $100,000; by Ross Houck, F. P. Cornish, T. A. Medlen, W. A. Farr, J. B. Furry and Robert N. Eggleston.

MINNEAPOLIS. — Pillsbury-Flour Mills Co. has given the general contract to Barnett & Record Co. for an elevator of concrete and steel construction, to cost $250,000.

ST. PAUL.—A. H. Stem, Endicott building, has drawn plans and is taking bids for a department store, 150 x 204 feet, eight or 10 stories, of reinforced concrete, to cost $1,000,000.

ST. PAUL.—Charles L. Potter, U. S. engineer, will take bids until 2 p. m., Aug. 6, for furnishing excavating machinery of the drag line type fitted with orange peel bucket for dredge Manitou.

SOUTHERN STATES

LAGRANGE, GA.—Mayor will take bids until July 21 for water works station, filters, machinery and extensions; Jas. Nisbet Hazlehurst, consulting engineer, Alberta.

JACKSON, TENN.—Mobile & Ohio railroad will spend $600,000 for new shops at the Claymore yards and repairing the present shops here. District Superintendent B. B. Tolson says the company will soon double the track between here and Corinth.

WESTERN STATES

MILK RIVER, MONT.—U. S. Reclamation Service, Los Angeles, Cal., will take bids until 2 p. m., July 22, for furnishing material and erecting riveted steel pipes for the Milk River project.

REPUBLIC, WASH.—Fire at the sawmill of the Republic Lumber Co. ruined $15,000 worth of machinery.

SEATTLE, WASH.—The city council has appropriated $125,000 to complete the first unit of the auxiliary steam plant being erected by the light department; $425,000 bonds voted were recently validated by the supreme court of Washington.

MAPLETON, ORE. — C. A. Elkins and Frank Shelley, of Eugene, have been awarded a contract by Richard Clow to install a hydro-electric plant near here for generating power and light.

PORTLAND, ORE. — City department of highways and bridges has completed plans for a steel viaduct over Holgate street, to be constructed by the Oregon-Washington Railroad & Navigation Co. and the Southern Pacific Co.; estimated cost, $55,000.

CANADA

VANCOUVER, B. C.—Capitalists of this city and Portland, Ore., have awarded Klaw & Erlanger, Seattle, the contract for the Great Northern Theater to cost $200,000 and a hotel costing $750,000 to occupy the same building.

TORONTO, ONT.—National Iron Works has taken out a permit to erect a one-story pipe foundry of brick, steel, cement and gypsum to cost about $50,000.

TRADE NOTES

BEAVER DAM, WIS.—By the end of this week the Western Malleables Co., of Beaver Dam, Wis., virtual successor to the Beaver Dam Malleable Iron Co., bankrupt, will perfect its organization and lay its plans for future operation of the four large plants in Beaver Dam, which in the past have specialized in tie plates and other railroad malleable products. The new company is capitalized at $400,000. Directors have been elected as follows: Lawrence Fitch, Milwaukee; M. A. Jacobs, Beaver Dam; Ernest E. Smythe, Milwaukee. Mr. Fitch was vice president of the bankrupt company and a principal creditor. Mr. Smythe has been in charge of operations as trustee and receiver since last September and will probably continue as general manager of the company, with Mr. Fitch as president and Mr. Jacobs as secretary-treasurer. The directors will meet late this week to elect officers and will issue a formal statement thereafter.

CHICAGO.—Pickands, Brown & Co. will remove July 1 from their former quarters in the Continental and Commercial National Bank building, to suite 1315 McCormick building, 332 South Michigan avenue corner Van Buren street, Chicago. The company's new telephone number will be Wabash 6201. The new quarters are the offices formerly occupied by the American Sheet & Tin Plate Co. and the National Tube Co., which have removed to the new Continental and Commercial National Bank building, with other subsidiaries of the United States Steel Corporation.

MILWAUKEE, WIS. — The Ferdinand Pietsch Iron Works, Milwaukee, received the contract for all steel and iron work on the new warehouse for the Hansen Storage Co., Jefferson street, Milwaukee. It will cost $50,000.

NEW YORK CITY.—The Usines Carels Freres of Ghent, Belgium, which for some time has been selling Diesel engines into this country through its American representative, W. R. Haynie, 30 Church street, New York, has sold its American patent rights to the Nordberg Mfg. Co., Milwaukee. The negotiations were completed recently in Milwaukee by A. Luckman, managing director of the Carels company, and Bruno V. Nordberg, president of the Nordberg company. A representative of the Carels company now is at the Nordberg plant and the Nordberg company plans shortly to manufacture these Diesel engines upon an extensive scale.

Kreolite Floors

A Fitting Foundation for Shop Efficiency

Kreolite Block floor in plant of Defiance Machine Works, Defiance, Ohio

THE DEFIANCE MACHINE WORKS manufacture a superior quality of wood working machinery. To keep their manufacturing expense to a minimum their machinery and shop equipment must be highly efficient. For this reason Kreolite Block Floors were installed throughout their new plant.

NOTE from the view above the kind of work carried on over their floors, much heavy trucking, the handling of sharp, heavy castings, together with the wear and tear incident to a large machine shop.

IN order to be entirely satisfactory, their floors must be extremely durable; must be easy to truck over; must be comfortable for workmen and cause no maintenance expense.

WHEN building this plant many types of floor construction were considered. **Kreolite Wood Block Floors** were laid. A year later C. H. Kettenring, General Manager of the Defiance Machine Works, wrote us as follows:—

"We have subjected these floors to some very heavy service and they have stood up perfectly. We do not think there is a better floor on the market for a factory of our kind."

Your floors may receive similar wear or perhaps totally different. In either case our engineers have some interesting floor information that is yours for the asking. A card today will bring it.

THE JENNISON-WRIGHT COMPANY

309 HURON STREET TOLEDO, OHIO

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery Through Third Quarter.)

Bessemer, valley	$14.00
Bessemer, Pittsburgh	14.90
Basic, Pittsburgh	13.90
Basic, eastern Pa.	14.00 to 14.50
Malleable, Pittsburgh	13.90 to 14.40
Malleable, Chicago	14.00
Malleable, Philadelphia	15.50 to 15.75
Malleable, Buffalo	13.00 to 13.50
No. 1X Philadelphia	15.00 to 15.25
No. 2 foundry, Pittsburgh	13.90 to 14.40
No. 2 foundry, Cleveland	13.75 to 14.25
No. 2 foundry, Ironton	13.00 to 13.50
No. 2 foundry, Chicago	14.00
No. 2X foundry, Philadelphia	14.75 to 15.00
No. 2X foundry, New York	14.50 to 14.75
No. 2X foundry, Buffalo	13.00 to 13.50
No. 2 plain, Philadelphia	14.50 to 14.75
No. 2 plain, New York	14.25 to 14.50
No. 2 plain, Buffalo	13.00 to 13.25
No. 2 southern, Birmingham	10.00 to 10.50
No. 2 southern, Cincinnati	13.25 to 13.75
No. 2 southern, Chicago	14.85 to 15.85
No. 2 southern, Philadelphia	15.00 to 15.25
No. 2 southern, Cleveland	14.60 to 14.85
No. 2 southern, New York	14.75 to 15.00
No. 2 southern, St. Louis	14.50 to 15.00
Virginia, 2X, Philadelphia	15.30
Virginia, 2X, Jersey City	15.85 to 16.10
Virginia, 2X, New Eng., all rail	16.25
Gray forge (eastern Pa.)	13.75 to 14.00
Gray forge, Pittsburgh	13.65
Gray forge, Birmingham	9.00 to 9.50
Silveries, 8 per cent, Cleveland	17.55
Silveries, 5 per cent, Birmingham	12.50
Silveries, 5 per cent, Chicago	16.85
Standard low phos., Phila.	20.50
Lebanon low phos., furnace	17.00 to 17.50
Low phos., Pittsburgh	21.65 to 21.90
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	15.75 to 16.50
Charcoal, Buffalo	15.75 to 16.75
Charcoal, Birmingham	25.00
Middlesbrough, No. 3, Phila., ex ship	15.00 to 15.25

IRON ORE

(Lower lake ports.)

Old range Bessemer, 55 per cent.	$3.75
Mesabi Bessemer, 55 per cent.	3.50
Old range, non-Bess., 51½ per cent.	3.00
Mesabi, non-Bessemer, 51½ per cent.	2.85

(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent.	7 to 8c
Foreign non-Bess., 50 to 65 per ent.	7 to 8c

COKE

(At the ovens.)

Connellsville furnace	$1.75 to 1.85
Connellsville fur. contr.	1.85 to 2.00
Connellsville foundry	2.35 to 2.60
Connellsville fdy., contr.	2.40 to 2.65
Wise county furnace	1.90 to 2.10
Wise county foundry	2.25 to 2.75
Pocahontas furnace	1.90 to 2.05
Pocahontas foundry	2.25 to 2.40
New River, foundry	2.75 to 3.50
New River, furnace	2.20 to 2.35

FERRO-ALLOYS

Ferro-manganese, Baltimore	$38.00
Ferro-silicon, 50 per cent, Pbgh.	71.00 to 73.00
Ferro-silicon, 50 per cent, Phila.	71.00 to 73.00
Ferro-sil., 12 to 13 per cent, Pgh.	22.90
Ferro-sil., 11 to 12 per cent, Pgh.	21.90
Ferro-sil., 10 to 11 per cent, Pgh.	20.90
Ferro-sil., 9 to 10 per cent, Pgh.	19.90
Ferro-carbon titanium, carloads, per lb.	8c to 12½c

SEMI-FINISHED STEEL

Bess. billets, Pbgh. and Yn.	$19.50 to 20.00
Open-hearth bil., Pbgh. and Yn.	19.50 to 20.00
Open-hearth bil., Phila.	21.90 to 22.40
Bess. sheet bars, Pbgh. and Yn.	20.50 to 21.00
Op.-h'th sh. bars, Pbgh. & Yn.	20.50 to 21.00
Forging billets, Phila.	26.40 to 27.40
Forging billets, Pittsburgh	24.00 to 25.00
Wire rods, Pittsburgh	25.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh.	1.25c
Stand. open-hearth rails, Pbgh.	1.34c
Light rails, 8 lbs., Pbgh. or Chi.	1.40c
Lgt. rails, 12 lbs., Pbgh. or Chgo.	1.35c
Lgt. rails, 16 to 20 lb., Pbgh. or Chicago	1.30c
Lgt. rails, 25 to 45 lbs., Pbgh. or Chicago	1.25c
Relaying rails, standard, Chgo.	$23.00 to 24.00
Relaying rails, light, Chicago	21.50 to 22.50
Angle bars, st. sect. Pbgh., base	1.50c
Angle bars, st., sections, Chgo.	1.50c
Spikes, railroad, Pbgh.	1.40c to 1.45c
Spikes, railroad, Chgo.	1.55c
Track bolts, Pbgh.	2.00c
Track bolts, Chgo.	2.00c

SHAPES, PLATES AND BARS

Structural shapes, Pittsburgh	1.10c to 1.15c
Structural shapes, Chicago	1.28c to 1.33c
Structural shapes, Philadelphia	1.25c to 1.30c
Structural shapes, New York	1.26c to 1.31c
Structural shapes, San Francisco	2.00c to 2.05c
Tank plates, Chicago	1.28c to 1.33c
Tank plates, Pittsburgh	1.10c to 1.15c
Tank plates, Philadelphia	1.25c to 1.30c
Tank plates, New York	1.26c to 1.31c
Bars, soft steel, Pittsburgh	1.10c to 1.15c
Bars, soft steel, Chicago	1.28c to 1.33c
Bars, soft steel, Philadelphia	1.30c
Bars, soft steel, New York	1.31c
Hoops, carloads, Pittsburgh	1.25c

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 pounds, to:—

New York	16 cents
Philadelphia	15 cents
Boston	18 cents
Buffalo	11 cents
Baltimore	14½ cents
Cleveland	10 cents
Cincinnati	15 cents
Chicago	18 cents
Minneapolis and St. Paul	32 cents
Denver	67½ cents
St. Louis	22½ cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, plates and shapes	80 cents

Hoops, less carloads, Pittsburgh	1.30c
Bands, Pittsburgh	1.10c to 1.15c
Shafting, carloads, Pbgh., disc. contract	66
Shaft'g carloads, Pbgh., prompt,	67
Shaft'g less carl'ds, Pbgh., disc.	63
Bar iron, Chicago	1.05c to 1.10c
Bar iron, Philadelphia	1.20c to 1.25c
Bar iron, New York	1.25c to 1.30c
Bar iron, Cleveland	1.20c
Bar iron, Pittsburgh	1.25c
Hard steel bars, Chicago	1.25c to 1.30c
Smooth finish'g mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	1.80c to 1.90c
No. 28, black, Chicago	1.98c to 2.03c
No. 28, tin mill, black, Pbgh.	1.80c to 1.90c
No. 28, galvanized, Pbgh.	2.75c to 2.85c
No. 28, galvanized, Chgo.	2.93c to 2.98c
No. 10, blue annealed, Pbgh.	1.35c
No. 10, blue annealed, Phila.	1.50c
Tin plate, 100 lb., coke, base	$3.30 to 3.40

IRON AND STEEL PIPE

(Pittsburgh.)

	Black Butt-weld.	Galv. Butt-weld.
Steel, ⅜ to 3 inches	80	71½
Iron, ⅜ to 2½ inches	70	61
	Lap-weld.	
Steel, 2½ to 6 inches	79	70½

BOILER TUBES

Steel, 3½ to 4½ inches	73
Iron, 3½ to 4½ inches	60

WIRE PRODUCTS

Wire nails, jobbers, Pittsburgh	$1.50 to 1.55
Wire nails, retailers, Pittsburgh	1.55 to 1.60
Plain wire, jobbers, Pittsburgh	1.30 to 1.35
Plain wire, retailers, Pittsburgh	1.35 to 1.40
Galvanized wire, jobbers, Pbgh.	1.70 to 1.75
Galvanized wire, retailers, Pbgh.	1.75 to 1.80
Polished staples, Pbgh.	1.50 to 1.55
Galvanized staples, Pbgh.	1.90 to 1.95
Barb wire, painted, jobbers, Pbgh.	1.50 to 1.55
Barb wire, painted, retail'rs, Pbgh.	1.55 to 1.60
Barb wire, galv., retailers, Pbgh.	1.95 to 2.00
Barb wire, galv., jobbers, Pbgh.	1.90 to 1.95

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 80 and 10; cut threads, 80 and 5; larger or longer, 75 and 10.

Machine bolts with hot pressed nuts ⅜ x 4 inches, smaller or shorter, rolled, 80 and 15; cut, 80 and 10; larger or longer, 75 and 15.

Gimlet and cone point lag or coach screws, 80 and 20.

Hot pressed square, blank or tapped nuts, $6.30 off list; hot pressed hexagon blank or tapped, $7.20 off.

Cold pressed, C. & T. square, blank or tapped, $6 off; hexagon, blank or tapped, ⅝ inch and larger, $7.20; ½-inch and smaller, $7.80.

RIVETS

Structural rivets, Pbgh.	1.50c to 1.65c
Structural rivets, Chgo.	1.68c
Boiler rivets, Pbgh.	1.60c to 1.75c
Boiler rivets, Chgo.	1.78c

SCREWS

(New York.)

Lag, gimlet and cone point	80 and 20
Coach, gimlet point	80
Standard jack	70 and 10
Mch., cut thread, flat head	50 and 10
Mach., cut thread, round head	50 and 10 and 10
Mch., cut thread, fillister hd.	40 and 40 and 10
Mch., rolled thread, flat head or round head	80 and 10
Set screws, iron	75 and 10 and 10
Set screws, steel, per cent advance over iron	25
Square head cap screws	70 and 10 and 10
Hexagon head cap screws	70 and 10 and 10
Fillister head cap screws	60 and 10 and 10
Flat head wood screws	10 and 10 and 5
Round head wood screws	10 and 10 and 5

WASHERS

(Discounts, Iron or Steel, to Jobbers, Cleveland.)

⅛-inch	$7.25
⅛-inch	7.00
½-inch	7.00
⅝-inch	7.00
¾-inch	7.00

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.55c to 1.60c

TWISTED REINFORCING BARS

(Soft steel, Pittsburgh mill.)

¾-inch and larger	1.25c
⅝-inch	1.30c
½-inch	1.35c
⅜-inch	1.50c
¼-inch	1.75c

IRON AND STEEL PRICES

Corrected up to Tuesday noon

TACKS

(New York.)—

	Discount.
American carpet tacks	90 and 20 and 10
American cut tacks	90 and 20 and 10
Railroad tacks	90 and 40
Gimp tacks	90 and 20 and 10
Finishing nails	70

WIRE ROPE

Galvanized, iron and steel	47½ and 2½
Bright, Iron and steel	55 and 2½

TRIANGLE REINFORCING MESH

(Per 100 square feet f. o. b. mill, car loads.)

No. 4, plain	$1.00
No. 4, galvanized	1.12
No. 7, plain	.49
No. 7, galvanized	.55
No. 23, plain	1.69
No. 23, galvanized	1.88
No. 26, plain	1.17
No. 26, galvanized	1.30
No. 27, plain	.96
No. 27, galvanized	1.07
No. 31, plain	2.49
No. 31, galvanized	2.76
No. 35 plain	1.17c
No. 35 galvanized	1.30
No. 39, plain	3.05
No. 39, galvanized	3.38
No. 43, galvanized	1.23
No. 43, plain	1.10

SPIRAL RIVETED PIPE

(Per 100 linear feet, f. o. b. factory.)

4-inch, plain	$ 19.76
4-inch, galvanized	30.74
6-inch, plain	33.05
6-inch, galvanized	49.73
8-inch, plain	43.17
8-inch, galvanized	65.00
10-inch, plain	66.42
10-inch, galvanized	96.15
12-inch, plain	83.75
12-inch, galvanized	118.30
14-inch, plain	99.14
14-inch, galvanized	138.85
16-inch, plain	117.53
16-inch, galvanized	166.58
20-inch, plain	183.79
20-inch, galvanized	248.39
24-inch, plain	219.92
24-inch, galvanized	293.99
30-inch, plain	324.81
30-inch, galvanized	430.64

CAST IRON PIPE

Three to 24 in., Cleveland	$22.35 to 22.80
Four-inch, water, Chicago	26.50
Six to 12 inches, Chicago	24.50
Larger sizes, Chicago	24.00
Six inch, water, New York	20.50 to 21.50
Four-inch, water, Birmingham	21.50
Six-inch and larger, Birmingham	19.50
Gas pipe, $1 per ton higher than water.	

WAREHOUSE PRICES

Steel bars, Chicago	1.65c
Steel bars, Cleveland	1.80c
Steel bars, Cincinnati	1.70c to 1.85c
Steel bars, Philadelphia	1.65c
Steel bars, New York	1.80c
Iron bars, Chicago	1.65c
Iron bars, Cleveland	1.75c
Iron bars, Cincinnati	1.65c to 1.75c
Iron bars, Philadelphia	1.60c to 1.65c
Iron bars, New York	1.65c to 1.70c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	1.75c
Shapes and plates, Cleveland	1.90c
Shapes and plates, Cincinnati	1.80c to 1.90c
Shapes and plates, Philadelphia	1.65c
Shapes and plates, New York	1.85c
No. 10 blue ann. sheets, Chgo	1.85c
No. 10 blue ann. sheets, Cleve	2.15c
No. 10 blue ann. sheets, Cinci	1.95c
No. 28 black sheets, Chgo	2.45c
No. 28 black sheets, Cleveland	2.60c
No. 28 black sheets, Cincinnati	2.45c to 2.55c
No. 28 galv. sheets, Chgo	3.45c
No. 28 galv. sheets, Cleveland	3.60c
No. 28 galv. sheets, Cincinnati	3.40c to 3.55c

IRON AND STEEL SCRAP

(Net tons.)

No. 1 railroad wrought Chgo	$ 9.00 to 9.25
No. 1 railroad wrought, Cleve	9.50 to 10.00
No. 1 railroad wrought, St. L	7.75 to 8.00
No. 1 railroad wrought, Cinci	8.00 to 8.50
No. 2 railroad wrought, Chgo	8.75 to 9.00
No. 2 railroad wrought, St. L	7.50 to 7.75
Arch bars and transoms, Chgo	12.50 to 12.75
Arch bars and transoms, St. L	11.00 to 11.50
Knuckles, coup. and spr'gs, Chgo.	9.00 to 9.50
Knuckles, coup. & sp'gs, St. L.	9.25 to 9.50
Shafting, Chicago	11.50 to 12.00
Shafting, St. Louis	13.00 to 13.50
Steel car axles, Chgo	12.00 to 12.25
Steel car axles, St. Louis	11.75 to 12.25
Locomotive tires, Chicago	9.25 to 9.50
Locomotive tires, St. Louis	8.75 to 9.25
Cut forge, Chicago	8.75 to 9.00
Pipes and flues, Chicago	7.00 to 7.25
Pipes and flues, Cleveland	7.75 to 8.25
Pipes and flues, St. Louis	5.75 to 6.25
No. 1 cast, Chicago	9.75 to 10.00
No. 1 cast, Cleveland	10.00 to 10.50

Freight Rates, Coke

Connellsville regions, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.70
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley furnaces	1.20
Cincinnati	2.00

No. 1 cast, Cincinnati	$ 9.25 to 9.75
No. 1 cast, St. Louis	9.50 to 10.00
No. 1 busheling, Chicago	7.50 to 7.75
No. 1 busheling, Cleveland	8.50 to 9.00
No. 1 busheling, Cincinnati	6.00 to 6.50
No. 1 busheling, St. Louis	7.25 to 7.50
No. 2 busheling, Chicago	6.00 to 6.25
No. 1 boiler plate, cut, Chgo	6.50 to 7.00
No. 1 boiler plate, cut, Buffalo	9.00 to 9.50
No. 1 boiler plate, cut, St. L	6.00 to 6.50
Boiler punchings, Chicago	9.00 to 9.25
Cast borings, Chicago	4.75 to 5.25
Cast borings, Cleveland	6.00 to 6.25
Cast borings, Cincinnati	4.25 to 4.75
Cast borings, St. Louis	4.00 to 4.50
Machine shop turnings, Chgo	5.25 to 5.50
Machine shop turnings, Cleve	5.25 to 5.50
Machine shop turnings, Cinci	4.50 to 5.00
Machine shop turnings, St. L	4.50 to 5.00
Malleable, agl., Chicago	7.75 to 8.25
Malleable, agricultural, St. Louis	7.50 to 8.00
Malleable, railroad, Chicago	8.75 to 9.00
Malleable, railroad, Cincinnati	6.50 to 7.00
Malleable, railroad, St. Louis	7.50 to 8.00
Angle bars, iron, Chgo	11.75 to 12.25
Angle bars, iron, St. Louis	10.00 to 10.50
Angle bars, steel, Chgo	8.25 to 8.75
Angle bars, steel, St. Louis	9.25 to 9.50
Stove plate, Chicago	8.50 to 8.75
Stove plate, Cleveland	7.75 to 8.00
Stove plate Buffalo	9.75 to 10.00
Stove plate, Cincinnati	6.50 to 7.00
Stove plate, St. Louis	8.25 to 8.75
Bundled sheet, Cincinnati	4.75 to 5.25
Wrought iron pil'g plates, Clev	13.00

(Gross Tons.)

Heavy melting steel, Pbgh	$11.25 to 11.75
Heavy melting steel, Buffalo	10.00 to 10.50
Heavy melting steel, Chicago	9.50 to 9.75
Heavy melting steel, Cleveland	10.25 to 10.60
Heavy melting steel, Cincinnati	9.00 to 9.50
H'vy melting steel, eastern Pa	10.50 to 11.00
Heavy melting steel, New York	8.50 to 8.75
Heavy melting steel, St. Louis	11.00 to 11.50
Bundled sheet, Buffalo	6.25 to 6.50
Grate bars, Buffalo	9.50 to 10.00
Grate bars, New York	5.75 to 6.00
No. 1 railroad wr'ght, east. Pa	12.50 to 12.75
No. 1 railroad wrought, Pbgh	11.50 to 12.00
No. 1 R. R. wght., New York	10.25 to 10.50
No. 1 R. R. wrought, Buffalo	11.00 to 11.50
Shafting, New York	12.00 to 12.50
Pipes and flues, New York	7.50 to 7.75
Pipes and flues, eastern Pa	9.25 to 9.75
Mch. shop turnings, New York	5.75 to 6.00
Machine shop turnings, Buffalo	5.50 to 6.00
Mch. shop turnings, Pbgh	7.75 to 8.00
Mch. shop turnings, eastern Pa.	7.50 to 8.00
Cast borings, New York	5.75 to 6.00
Cast borings, eastern Pa	8.00 to 8.50
Cast borings, Buffalo	6.00 to 6.50
Cast borings, Pittsburgh	8.00 to 8.25
Stove plate, (Jersey points)	8.50 to 8.75
Stove plate, Pittsburgh	10.00 to 10.25
Stove plate, eastern Pa	8.50 to 9.00
Shoveling steel, Chicago	9.00 to 9.50
Shoveling steel, St. Louis	8.00 to 8.25
Reroll'g rails, 5 ft. & ov., Pbgh.	13.00 to 13.25
Reroll. rails, 5 ft. and ov., Chgo.	11.25 to 11.75
Reroll. rails, 5 ft. and ov., Cleve.	11.00 to 11.50
Reroll. rails, 5 ft. & ov., E. Pa.	12.25 to 12.75
Reroll. rails, 5 ft. and ov., St. L.	11.25 to 11.50
Steel rails, short, Chicago	10.25 to 10.50
Steel rails, short, Cleveland	13.00 to 13.25
Steel rails, short, eastern Pa	11.00 to 11.25
Steel rails, short, St. Louis	10.50 to 10.75
Iron rails, Cleveland	13.50 to 14.00
Iron rails, Cincinnati	10.50 to 11.00
Iron rails, eastern Pa	15.00 to 16.00
Iron rails, St. Louis	11.00 to 11.25
Frogs, switches, guards, Chgo	9.50 to 9.75
Frogs, switches and g'rds, St. L.	10.50 to 10.75
Car wheels, (iron), Pittsburgh	11.25
Car wheels, (steel), Pittsburgh	12.25 to 12.50
Car wheels, Chicago	10.75 to 11.00
Car wheels, eastern Pa	11.00 to 11.50
Car wheels, Buffalo	12.00 to 12.50
Car wheels, N. J. points	10.50 to 11.00
Car wheels, St. Louis	11.00 to 11.25
Iron axles, Pittsburgh	21.50 to 22.00
Iron axles, Cincinnati	19.00 to 20.00
Iron axles, eastern Pa	20.00 to 21.00
Iron axles, Buffalo	21.50 to 22.00
Iron axles, Chicago	19.00 to 19.50
Steel car axles, New York	12.25 to 12.75
Steel car axles, Buffalo	15.00 to 15.50
Steel car axles, Cleveland	14.00 to 16.00
Steel car axles, eastern Pa	14.00 to 14.50
No. 1 busheling, Buffalo	8.50 to 9.00
No. 1 busheling, Pittsburgh	10.00 to 10.25
No. 2 busheling, Buffalo	6.00 to 6.50
Low phosphorus steel, Buffalo	15.00 to 15.50
Low phosphorus steel, Pbgh	13.75 to 14.25
Low phos. steel, eastern Pa	14.50 to 15.00
No. 1 forge, eastern Pa	8.50 to 9.00
No. 1 cast, eastern Pa	12.00 to 12.50
No. 1 cast, Pittsburgh	11.25 to 12.25
No. 1 heavy cast (N. J. points)	11.25 to 11.50
Boiler plate, Cleveland	8.50 to 9.00
Mall. iron, agricul., Cleveland	9.00 to 9.50
Mall. iron R. R. Cleveland	10.25 to 10.75
Malleable, railroad, Pittsburgh	10.50 to 10.75
Malleable R. R. Buffalo	10.75 to 11.25
Mall., R. R. east. Pa	9.00 to 9.50
Bundled sheet, Pittsburgh	8.50 to 8.75
Bundled sheet, Cleveland	7.50 to 8.00

MISCELLANEOUS SHOP TOOLS

	Discount.
Standard files	80 and 5
Heavy hammers, 3 to 5 lb	80 and 10
Heavy hammers, over 5 lb	80 and 5
Gas pliers, 7-inch, per dozen	$2.00
Gas pliers, 12-inch, per dozen	3.50
Cold chisels, per pound	10c to 15c
Wrenches, Alligator, discount	75 and 80
Wrenches, drop forged S	50 and 10

STEEL PLATE CONSTRUCTION
Riveted and Welded Tanks
of every description
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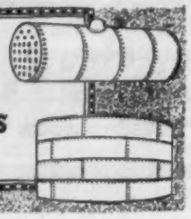

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WE desire to make arrangements to furnish Manufacturers with **GREY IRON CASTINGS.** Manufacturers of machinery preferred. Our capacity at the present time is up to 1,000 lbs., single casting, and about three tons daily. Single casting capacity or daily output could be easily increased. Can make low prices.
ST. ALBANS FOUNDRY & IMPLEMENT COMPANY
ST. ALBANS, VT.

How to Make Good Car Wheels

(*Continued from page* 71)

cannot say, and it is hoped to get some connection between this trouble and the different coefficients of expansion of the compounds forming the metal.

Experiments have been in progress for some time and many test heats have been taken off. The fuels used have been high and low-sulphur cokes and anthracite coal, and the mixtures have varied from all-scrap wheels to mixtures with charcoal iron and malleable and steel scrap. Six test wheels have been cast from each test heat, of which two each have been thermal, drop and flange tested. Up to the present there has been no improvement on our standard mixture containing scrap steel. There have been only a few analyses and the tests, to show improvement, have been confined to those ordinarily made on wheels and bars, as given above. Our test work is to continue and it is our expectation that we will find mixtures and perhaps methods to improve the cast iron wheel.

Electric Substations in Mines

(*Continued from page* 74)

and installed require little attention, and the attendant is needed only to reset circuit breakers and to see that everything is running properly. If power is not wanted the machines can be cut out and all expense for current stopped. Starting up is a simple matter of closing a switch and full power is available immediately.

With purchased power, the substation system of power distribution is most advantageous for coal companies operating singly or widely separated mines. The operator transfers his responsibility to those whose business it is to carry it, leaving him free to his business of mining coal, thus relieving him of the worry and care of his power plant, and thereby greatly increasing the efficiency of his coal mining department. The operator substitutes his power house with its engineers and firemen and its need for good and abundant water, with a small substation that requires only one attendant and no water supply.

Locating the Substation

The exact location of the substation is often a hard question to decide. Conditions frequently arise where it would be desirable to install the substation underground, but in general, unless absolutely necessary, the substation should be placed above ground. The preferable location is at the pit mouth when possible, as it can then be looked after by a workman who has other duties to perform. In a small mine the tipple foreman can attend to the station, while in a shaft mine the station should be located in the hoist room and looked after by the hoist engineer. In a large mine, requiring more than one station, they should be located centrally to the work to save the expense of heavy copper feeders. The substation can often be located near the fan so that the same operator can look after both. When direct current feed wires cannot be carried into the mine by one of the openings, bore holes can be used, as it is comparatively simple to maintain a 500-volt cable installed in a bore hole.

In regard to locating the substation underground there are many objections to this. Beside the source of danger from fire there is most always considerable dampness underground, which not only weakens the insulation, but causes corrosion of unprotected metallic parts. It is practically impossible to make an underground substation free from moisture, and good ventilation is often difficult

to obtain. This matter of ventilation is very important, as the head losses in the apparatus must be carried away so that the capacity of the machines will not be impaired. This question will be readily appreciated when it is considered that one kilowatt loss per minute is equal to 57 B. T. U., which is equivalent to heating about 3,001 cubic feet of air one degree Fahrenheit per minute. The total loss in a 200-kilowatt station will be approximately 15 kilowatts. The heat generated will, however, help to keep the substation dry in conjunction with proper drainage and pumping.

All underground substations should be ventilated with intake air and all high-tension cables should, when possible, be carried to the substation in the intake airway. This may work a hardship particularly if the mine is shaft operated and a blowing fan is used, as it is practically impossible to maintain wires in a shaft of this kind on account of the high air velocity. The writer knows of mines of this type where it is unsafe for a man to attempt to ascend the stairway, much less do any work while the fan is in operation.

Cost of Construction

Very often considerable coal dust and pure sand is picked up by the air currents which is a rather severe matter, as the dust and sand plays havoc with the bearings and oiling systems.

A very important point regarding the construction of an underground substation is the cost of construction, which is considerably greater than building on the surface. Since there is always danger of the roof giving way, it should be arched or built of heavy reinforced concrete and the whole station made fireproof. For a 200-kilowatt substation the dimensions should not be less than 24 x 24 x 12 feet.

With the substation located underground it is generally necessary to carry a high-tension cable through a bore hole. With the station located on the surface this cable will be a low-tension cable and there will be no trouble to maintain it. A satisfactory method is to use "lead" covered cable attached to a messenger cable about every 30 feet by wiped joint or suitable clamps which will not injure the lead. The high-tension cable is much more difficult to maintain, and most mine electricians know what it means to maintain high-tension insulated cable in deep shafts and in bore holes.

The question of attendance for an underground substation is a serious one and actual experience has taught the writer that it is impossible to get men underground to give machinery the same attention they will give it on the surface. This is particularly true of the night shift, as it has been found that there is a greater tendency among men to sleep on the night shift in mines, than on the same shift outside.

In regard to the general design and construction of a mine substation, space economy should be given consideration, but care must be exercised to see that there is plenty of room for making repairs and replacements.

The operating requirements of a substation in regard to continuous service may vary from a few hours per day to practically continuous service. As due provision must be made for inspection and repairs, it is quite evident that in case of continuous operation attention must be given to the proper sectionalization of the apparatus and duplication of the equipment.

The substation should be constructed of fireproof material, and all high-voltage apparatus should be enclosed to secure maximum safety to attendants. Asbestos lumber should be used for partitions and doors, which serves as a protection against shock and is a valuable protection in case of fire.

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Notice our immense up-to-date plant.
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Our Foundry is 160 x 80 ft. Our General Machine Shop is 400 x 80 ft., enabling us to turn out work up to 16 ft. in dia.
We also have a large Pattern Shop complete in every detail.
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Taylor-Wharton Iron & Steel Co.
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SMALL STEEL CASTINGS
OF THE BEST QUALITY ARE OUR SPECIALTY.
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Intricate Molding?
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We'll be glad to figure on your requirements for **intricate molding** of all descriptions.
We have exceptional facilities for giving you service. We also specialize **Gray Iron, Semi-Steel** and **Chilled Castings.**
We have a capacity of 25 tons a day.
Write us.

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EAU CLAIRE, WISCONSIN
WORKS ON NORTH SIDE

Opportunities

Men Wanted
Minimum, 50 words, $1.00. Each additional word, 2c. All capitals, 50 words, $1.50. Each additional word, 3c.

Position Wanted
Minimum, 25 words, 50c. Each additional word, 2c. All capitals, 25 words, 75c. Each additional word, 3c.

Miscellaneous Classified
Minimum, 25 words, $1.00. Each additional word, 4c. All capitals, 25 words, $2.00. Each additional word, 8c.

Men Wanted

UNDERSIGNED COUNSEL WILL CONFIDENTIALLY negotiate preliminaries for important executive, technical, administrative and professional positions, insuring strictest privacy. Not an agency, but a highly-endorsed, high grade method of negotiating preliminaries only, for $3,000 to $12,000 men. Send address only for explanation. R. W. Bixby, Lock Box 134-E9, Buffalo, N. Y.

FOREMAN MACHINIST—TWO (2) GOOD experienced foremen wanted by large manufacturing concern, to work under head foreman; expected to alternate each week day and night turn; ability to handle men and turn out work economically and accurately the requirements; steady work at all times. Address Box 188, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — A-NO. 1 FOREMAN FOR gray iron foundry in middle west doing railroad work; open shop; must be a hustler; state age, experience and references, also salary wanted. Address Box 189, THE IRON TRADE REVIEW, Cleveland, O.

WANTED—A HEATER FOR 14-INCH mill. Buffalo Steel Co., Tonawanda, N. Y.

THE BEST WAY TO GET A GOOD POSITION in drafting or engineering is to file an application direct with some of our clients who are depending on us to get competent and experienced applicants for their vacant positions. Send stamp for blank and list of vacant positions. The Cleveland Engineering Agency Co., Rose building, Cleveland, O.

Positions Wanted

STEEL FOUNDRY SUPERINTENDENT of wide experience looking for position; used to all classes of steel casting work; can get results; good references. Address Box 192, THE IRON TRADE REVIEW, Cleveland.

MECHANICAL ENGINEER, TECHNICAL graduate, 29 years of age, married; experienced as master mechanic of rolling mills, power plants and cement plants, or capable of taking charge of pattern shop, brass or iron foundry, machine shop or smith shop. Address Box 101, THE IRON TRADE REVIEW, Cleveland, O.

PRACTICAL SUPERINTENDENT DESIRES change from present position; experienced miner, mill designer, ore concentrator, technical chemist, surveyor, graduate mining metallurgist; iron, manganese, coal, limestone; 27; references. Address Box 110 THE IRON TRADE REVIEW, Cleveland.

DIRECTORS:

If different results are desired, now is the time. This EXECUTIVE is big enough to rearrange or rejuvenate a large proposition. Have changed run-down plants and losses to modern equipment and profits with minimum expenditure. Thorough technical, shop, designing, office, commercial and financial training combined. Successful record, reorganizing personnel and modernizing products, equipment, methods and financial conditions. 20 years' manufacturing experience, 4 years' under the Taylor System of Scientific Management. Would consider small proposition, if opportunity afforded acquiring substantial interest. Business must be financially sound. Address Box 201, THE IRON TRADE REVIEW, Cleveland, O.

YOUNG, TIRELESS, COMPETENT man, fully qualified by widely successful statistical, economic, production and financial experience as OPERATING MANAGER OF STEEL PLANTS, desires operating metallurgical or executive position with rolling mill or foundry doing steady business, wherein his efforts will not be lost. Address Box 143, THE IRON TRADE REVIEW, Cleveland.

POSITION WANTED: — BLAST FURNACE and steel mill master mechanic of long experience in construction and operation is open for engagement; steam and electric power equipments given special attention. Address Box 132, THE IRON TRADE REVIEW, Cleveland, O.

FOUNDRY SUPERINTENDENT OR general foreman; up-to-the-minute in modern practice; 20 years' executive experience in largest iron, steel and malleable foundries; can lower manufacturing cost and solve most difficult shop problems; seeks change where results and close attention to business would be appreciated. References. Address Box 186, THE IRON TRADE REVIEW, Cleveland, O.

MILL SUPERINTENDENT — IRON OR steel; extensive experience in management; good executive and producer; references; guarantee results; moderate salary. Address Box 193, THE IRON TRADE REVIEW, Cleveland, O.

POSITION WANTED BY MAN WITH ten years' experience to take charge of foundry office; understands estimating, costs, cupola practice, etc.; prefer New England location. Address Box 196, THE IRON TRADE REVIEW, Cleveland, O.

AMERICAN, AGE 32, TWO YEARS SUPERINTENDENT drilling and pumping oil; five years selling mill supplies; two years assistant in operating and sales departments forge plant. Best character and ability references and reason for change. Address Box 198, THE IRON TRADE REVIEW, Cleveland.

EMPLOYERS DESIRING TO INCREASE efficiency in office, shop or factory, will be able to make known this fact to better advantage by placing a classified ad in THE IRON TRADE REVIEW than through any other means.

A PRACTICAL FOUNDRY FOREMAN would like to correspond with parties desiring a good reliable man. Address Box 187, THE IRON TRADE REVIEW, Cleveland, O.

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